Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Remediation Action Plan

Proposed Pool and Park Redevelopment
Kogarah War Memorial Pool, 78 Carwar Avenue
Carss Park

Prepared for
SJB Architects c/- SJB Planning

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	Signature	Date
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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

Executive Summary

This Remediation Action Plan (RAP) describes the work required to remediate the property identified as Kogarah War Memorial Pool, Carss Park ('the site') to render the site suitable for the proposed pool and park redevelopment. The scope of remediation is based on the results of previous contamination investigations and the details of the proposed redevelopment.

The objectives of the RAP are to:

- Establish an appropriate remediation strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- Establish the site remediation acceptance criteria to be adopted and the validation requirements to confirm the successful implementation of the remediation strategy;
- Provide information on appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and
- Provide information on work health and safety procedures required to complete the remediation works in a manner that would mitigate risk to the health of site workers or users.

The deeper fill is to be left *in situ* and managed through a Long Term Environmental Management Plan (LTEMP) and local authority notification. The notification would allow Georges River Council to record this information in its property information system.

The remediation approach for all fill in the upper 2 - 3 m comprises off-site disposal of soils excavated to meet design levels and management of the remaining fill through implementation of a cap and management strategy. The cap will primarily be 0.5 m thick comprising imported fill and topsoil. The cap will be amended for Tree Protection Zones (TPZ) to minimise impacts on the root zones for retained trees. Moreover, for deeper planting areas of new trees the capping thickness will generally be greater than 0.5 m.

This preferred remediation approach has been selected given:

- The non-volatile nature of the contamination that is to be retained below the bulk earthworks level;
- The NSW EPA objective of minimising waste generation (i.e., disposal of soils to landfill);
- The shallow groundwater level at the site which the contaminated fill extends below. In this regard, disturbance and excavation of fill below the water table has the potential to impact on water quality. Moreover, the feasibility of lowering the groundwater table below the fill level without significant works is limited given the site's location adjacent to Kogarah Bay and the estuarine deposits that underlay the fill;
- The presence of ASS and the requirement to minimise potential impacts on the environment from ASS during works. This is achieved though minimising both the disturbance of the ASS and lowering of the groundwater table;
- The need to consider geotechnical requirements for potential reuse of site won soils (e.g., sorting / sieving) and the associated asbestos risks that would need to be managed during works;
- Minimising the disturbance of fill within the TPZ for retained trees; and

- Management of the deeper fill below 3 m depth is proposed, which therefore already requires the implementation of an LTEMP for the site.

The successful completion of the remediation is to be validated and reported as outlined herein and a LTEMP is to be developed for the site.

In summary, it is considered that the site can be rendered suitable for the proposed development subject to appropriate remediation, management and site validation in accordance with this RAP.

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1. Introduction

1.1 General

This Remediation Action Plan (RAP) describes the work required to remediate the property identified as Kogarah War Memorial Pool, Carss Park ('the site') to render the site suitable for the proposed pool and park redevelopment (refer to Drawing 1, Appendix A). The RAP was commissioned SJB Planning Pty Ltd (SJB) on behalf of SJB Architects Pty Ltd for Georges River Council and was undertaken in general accordance with Douglas Partners Pty Ltd (DP) proposal SYD200681.P.001.Rev0 dated 1 July 2020.

The area of proposed redevelopment and hence subject to remediation is defined by the site boundary as shown in Drawing 1, Appendix A.

The remediation strategy outlined herein comprises a cap and contain approach for the contaminated soils impacted by heavy metals and Asbestos Containing Materials (ACM) in the upper 3 m. The deeper fill is proposed to be left *in situ* and managed through a Long Term Environmental Management Plan (LTEMP) and local authority notification. The notification would allow Georges River Council to record this information in its property information system (refer to Section 4.3.4 of the NSW EPA. *Contaminated Lanbd Management, Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, 2017).

The RAP includes an unexpected finds protocol and contingency measures to manage other issues which may arise during remediation and redevelopment works. The scope of remediation is based on the results of previous contamination investigations (see Section 4) and the details of the proposed redevelopment.

1.2 Site Identification

The approximately square shaped site covers an approximate area of 7,500 m^2. A swimming pool and associated single storey buildings currently occupy the majority of the site with grassed, trees and landscape areas surrounding these areas. The site information is summarised in Table 1 below and Drawing 1 (Appendix A) shows the site boundary and site layout.

Table 1: Site Information

Item	Description
Site Address	78 Carwar Avenue, Carss Park
Legal Description	• Lot 511, Deposited Plan 752056; • Part Lot 1, Deposited Plan 125981; and • Part Lot 376, Deposited Plan 111749.
Approximate Area	7,500 m^2
Zoning	RE1 - Public Recreation
Current Land Use	Recreational
Local Council Area	Georges River Council

1.3 Proposed Development

The proposed development involves the demolition of the existing pool and associated structures and underground infrastructure (e.g., pipes constructed of ACM), and conversion of the area to open space grassed areas forming a connection with the existing park to the north of the site. This may include some planting, pathways and small areas for seating and picnic shelters.

The site will be graded towards the north-east as indicated on the civil drawings provided in Appendix B.

Works also include the replacement of the existing irrigation tanks with a new tank on the southern side of the site. Shallow trenching (0.6 m deep and 1 m wide) will also be undertaken to connect a 110 mm diameter PN10 PE 100 irrigation pipe and a DN40 MD conduit for electrical cabling to the existing tanks to the new tank connection. Joints in the conduits that are below the site surface level will be sealed to mitigate the potential for gas ingress.

It is understood that the existing on-grade car park is to be retained.

2. Objectives and Scope

The objectives of the RAP are to:

- Establish an appropriate remediation strategy so as to render the site suitable, from a site contamination perspective, for the proposed development;
- Establish the site remediation acceptance criteria to be adopted and the validation requirements to confirm the successful implementation of the remediation strategy;
- Provide information on appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and

- Provide information on Work Health and Safety (WHS) procedures required to complete the remediation works in a manner that would mitigate risk to the health of site workers or users.

3. Site Information

3.1 Site Description

A site walkover was undertaken on 22 July 2020 by an Environmental Scientist from DP as part of the detailed site (contamination) investigation[1]. The following features were observed and noted, with photographs included in Appendix C for reference.

- The site was occupied by a swimming pool with associated single-storey buildings. The swimming pool was observed to have significant cracking in the walls;
- Central and western parts of the site were concrete paved or hardstand and there was some cracking evident;
- The eastern, northern and southern portions of the site were predominantly vegetated;
- No general storage of chemicals on site was observed, however, there was evidence of previous chemical storage associated with the operation of the swimming pool, including chlorine;
- Stormwater pits were visible throughout the site;
- Potential hazardous building materials such as fibre cement sheet and Synthetic Mineral Fibres (SMF) were present (including associated with in-ground pipes); and
- A large berm on the eastern boundary of the site indicated a significant amount of earthworks had occurred on the site.

In addition, to the west of the site was an asphalt car park connecting to Carwar Avenue that was investigated as part of the DP (2020a). This graded from street level down towards the north and the playing fields.

The observed surrounding land-use included the following:

- North: Public parkland and playing fields;
- East: Public walking path and Kogarah Bay;
- South: Public parkland and a small sandstone cottage; and
- West: Public asphalt car park, parkland and community buildings.

[1] DP, *'Report on Detailed Site (Contamination) Investigation, Proposed Pool and Park Redevelopment, Kogarah War Memorial Pool, Carss Park',* DP ref: 99751.00.R.001.Rev0, dated 14 September 2020 (DP, 2020a).

3.2 Regional Topography, Geology and Hydrogeology

The *Sydney 1:100 000 Geological Series Sheet* indicates that the site is underlain by man-made fill used to raise the natural surface elevation over former estuarine swamps and subaqueous estuarine margins. The estuarine deposits below the man-made fill typically comprise silty to peaty quartz sand, silt and clay.

The regional mapping also indicates that the headland to the south and west of the site is underlain by Hawkesbury Sandstone, which comprises medium to coarse-grained quartz sandstone with minor shale and laminite lenses. It is expected that the estuarine deposits within the site are underlain by Hawkesbury Sandstone at depth.

Further reference to the Sydney 1:100 000 Soils Landscape Series Sheet, prepared by the former NSW Department of Land and Water Conservation, indicated that the site lies within an area of disturbed terrain. Disturbed terrain comprises landscape that has been extensively disturbed by human activity, which has extensively modified the features of the original landscape.

The topographic contours for the site indicate the area is relatively flat, around RL 3 m AHD with regional topography sloping from west to east towards Kogarah Bay (LI&R Report page 6, Appendix D).

Given the site's location adjacent to Kogarah Bay, groundwater has been observed at relatively shallow depths in the installed groundwater wells (i.e., 1.5 m to 2.6 m bgl, refer to DP (2020a)) with some saline characteristics. Water levels may also be impacted by tidal influences.

3.3 Acid Sulfate Soils

Reference to the 1:25,000 NSW Acid Sulfate Soil Risk map for Kogarah indicates that the site lies within an area of disturbed terrain which poses an environmental risk, which requires soil investigations in the area for Acid Sulfate Soil (ASS). Previous investigations have indicated the presence of ASS within the natural soils and fill. The closest to surface being at approximately 2.4 m AHD (1.2 m bgl) in the north-western area of the site (TP121, refer to Drawing 2, Appendix A).

In this regard, whilst ASS are not typically associated with fill, DP has previously encountered this scenario in reclaimed areas where ASS has been recorded in the fill, possibly due to use of dredged or excavated sediments used in the fill or a mixing occurring with the bay sediment during fill placement / reclamation.

Based on the previous ASS results and proposed works, it is not expected that ASS would be encountered during works. Should any materials that are suspected of being potential ASS be excavated during remedial works, these would need to be subject to further ASS testing and possibly (lime) treatment. An ASS management plan would also need to be implemented in this scenario.

4. Previous Reports

The following reports were reviewed for preparation of this RAP:

- Construction Sciences Pty Ltd (CS), *'Geotechnical Investigation, Carss Park Swimming Pool, Carss Park'*, CS ref: 501790024, dated 12 November 2019 (CS, 2019a);
- CS *'Summary of Site Contamination, Carss Park Swimming Pool, 76 Carwar Avenue, Carss Park, NSW 2221'*, CS ref: 50462000024, dated 15 November 2019 (CS, 2019b);
- DP, *'Hazardous Building Materials (HBM) Survey, Kogarah War Memorial Pool, 78 Carwar Avenue, Carss Park NSW',* DP ref: 99751.02.R.001.Rev0, dated 10 August 2020 (DP, 2020b);
- DP, *'Report on Additional Geotechnical Investigation, Proposed Pool and Park Redevelopment, Kogarah War Memorial Pool, Carss Park',* DP ref: 99751.01.R.001.Rev1, dated 14 September 2020 (DP, 2020c);
- DP, *'Report on Detailed Site (Contamination) Investigation, Proposed Pool and Park Redevelopment, Kogarah War Memorial Pool, Carss Park'*, DP ref: 99751.00.R.001.Rev0, dated 14 September 2020 (DP, 2020a); and
- Moore Trees Arboriculture Services Pty Ltd (MT), (draft) *'Arboriculture Development Assessment Report, Kogarah War Memorial Pool, Carss Park, NSW, 2221'*, dated 19 August 2020 (MT, 2020).

Reference should be made to the relevant report for further information. The below is provide for summary information only.

4.1 CS (2019a)- Geotechnical Investigation and CS (2019b)- Contamination Summary

CS undertook a geotechnical investigation which incorporated contamination sampling and testing. It is noted that the contamination summary (CS, 2019b) is based on information from the geotechnical investigation and hence have been summarised together.

CS (2019a) included the drilling of six boreholes (BH01 to BH06) to depths of between 3.0 m and 13.5 m bgl using solid flight augers with standard penetration tests undertaken at 1.5 m depth intervals. The boreholes indicated that the site is underlain by 2.5 m to 4.5 m of fill (sand and clay), over the natural estuarine soil profile. The natural soils were mostly described as interbedded medium dense or denser sands and stiff to hard clays. In the boreholes to the north east of the site (BH02 to BH05) a layer of very loose to loose sand and / or soft to firm clay was encountered directly beneath the fill to a depth of between 5.2 m and 6.0 m bgl. Sandstone bedrock was encountered at depths ranging between 2.5 m and 13 m bgl in four boreholes.

CS test locations are shown on Drawing 2, Appendix A.

The contamination testing was undertaken as part of the site work to inform a waste classification assessment. It also compared the results to a residential land use (health investigation level (HIL) A) scenario to inform suitability of the site based on the results from the limited boreholes. It is unclear why a residential land use scenario was adopted given DP understands residential development has not previously (or is currently) proposed for the site. It may be that the screening criteria for this scenario was selected given they are the most conservative.

In summary, CS reported the following exceedances of the adopted HIL A and Ecological Investigation Level (EIL):

- BH1 (1.5-1.9): lead (1,270 mg/kg) exceeding the HIL (300 mg/kg) and zinc (2,250 mg/kg) exceeding the EIL (400 mg/kg);
- BH3 (0.8-0.95): B(a)P TEQ (3.3 mg/kg) exceeding the HIL (3 mg/kg) and B(a)P (2.4 mg/kg) exceeding the EIL (0.7 mg/kg);
- BH4 (3.8-3.95): zinc (590 mg/kg) exceeding the EIL (400 mg/kg);
- BH4 (2.9-3.0): detection of asbestos;
- BH5 (0.4-0.5): mercury (40 mg/kg) exceeding the HIL (40 mg/kg);
- BH5 (1.9-2.0): detection of asbestos and total coliform (23,000 org/s) exceeding the investigation criteria (1,000 org/s); and
- BH5 (2.8-2.95): total coliform (30,000 org/s org/s) exceeding the investigation criteria (1,000 org/s).

CS (2019b) indicated that the contamination status at the site, or whether it presents risks to human health or the environment, could not be ascertained based on the data available. It recommended that that a Stage 1 and Stage 2 site investigation and delineation/remediation investigations should be conducted to confirm if remediation is required and the nature and extent of remediation that is required.

Furthermore, CS (2019a) (page 6) concluded: *….'fill materials would be classified, as a minimum, General Solid Waste (Non-putrescible (GSW_NP)), however, the presence of asbestos in BH04 and BH05 indicates some areas of fill (to be delineated) would be classified as Special Waste (asbestos) subject to further leachability tests'. Soils from BH01 and BH05 may require additional treatment due the presence of pathogens…'*

It was noted that the natural soils below the fill did not record contamination, however, these samples recorded the presence of ASS. Moreover, all alluvial soils were assessed to be potential ASS and it was noted that depending on the quantity of the soils excavated an ASS management plan may be required.

4.2 DP (2020a)- Detailed Site (Contamination) Investigation

DP (2020a) was a detailed site contamination assessment comprising a review of previous reports (as also outlined herein) and an intrusive investigation involving sampling of soil and material from 19 boreholes and 11 test pits (see Drawing 2, Appendix A). Selected soil samples and five groundwater samples and five material samples were analysed for a combination of the following contaminants of concern and parameters: metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn); total recoverable and petroleum hydrocarbons (TRH/TPH); monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene - BTEX); polycyclic aromatic hydrocarbons (PAH); organochlorine pesticides (OCP); organophosphate pesticides (OPP); PCB; phenols; asbestos; toxicity characteristic leaching procedure (TCLP); per- and poly-fluoroalkyl substances (PFAS); nitrogen (ammonia, nitrate, nitrite); pH; cation exchange capacity (CEC), anions (chloride, sulphate, alkalinity); cations (calcium, potassium, magnesium, sodium); biological oxygen demand (BOD); chemical oxygen demand (COD); and microbiological (total coliform, faecal coliform and hydrocarbon utilising bacteria).

The investigation also included the existing car park to the west of the site/remediation area.

In summary, DP (2020a) identified that with respect to soil chemical contamination the following exceedances are to be remediated and / or further investigated (including delineation) for any development works in the relevant area.

- Chromium in samples BH102/2.5-3.0 and TP130/2.7-2.8 due to HIL exceedances;
- Lead in sample BH1/1.5-1.9 (from CS (2019a)) due to HIL exceedance;
- Zinc in sample BH1/1.5-1.9 (from CS (2019a)) due to EIL exceedance;
- B(a)P TEQ in samples BH106/0.8-1.0 and TP124/0.8-0.9 due to HIL exceedances;
- TRH fraction F2 in sample BH111/1.7-1.8 due to ESL exceedance; and
- TRH fraction F3 in samples BH106/0.8-1.0, BH111/1.7-1.8, BH111/2.4-2.8 and TP124/0.8-0.9 due to ESL exceedances.

It was noted that sample TP124/0.8-0.9 is located in the eastern berm at around 4 m AHD, and hence would be excavated as part of the works to reach a final surface level of around 3 m AHD. This would therefore address the HIL and ESL exceedances noted at TP124 provided the excavated soils are not relocated within the site at a shallower depth.

Regarding the lead and zinc exceedance recorded in CS (2019a), these were identified to be within the tree protection zone (TPZ) and at depth. Given the results in the adjacent test pit (TP130) recorded significantly lower metal concentrations in samples TP130/0-0.1 and TP130/1-1.2 and the potential damage and limitations due to excavating within the TPZ (i.e., limited to 0.1 m to 0.15 m depth), removal of this contamination was considered to provide an overall negative outcome for the project and hence, it was recommended that this contamination be left in place and managed.

With respect to the chromium exceedance in sample TP130/2.7-2.8, given the depth at which the sample was taken, the non-volatile nature of the metal contamination and the shallow nature of groundwater at the site, it was considered that this could be addressed through generation of a barrier between the contamination and site users and managed under a LTEMP.

Moreover, sample locations BH102, BH106 and BH111 would not require remediation for the project given they are located outside the project area subject to the development application (i.e., located in the existing car park).

Apropos the asbestos contamination, given the detection of asbestos (at varying concentrations) in the vast majority of test pits, it was concluded that asbestos impacts are likely to be widespread at the site. It was noted that whilst a process of trying to remediate areas impacted with asbestos above the Site Assessment Criteria (SAC) could be considered, given the sporadic nature of asbestos contamination, there was considered a high risk that any such approach would result in greater areas requiring excavation than may be assumed based on the current data set. In addition, it was noted that the soils in the final landform would likely be impacted by asbestos, albeit at low concentrations within the SAC. Given this, the presence of ASS and the protection of tree root zones for those trees proposed to be retained, DP recommended a cap and contain remedial approach, thereby forming a physical barrier between the asbestos impacted soils and site users with the contamination managed under a LTEMP.

The fill in the upper 1.2 m was preliminarily classified as General Solid Waste (non-putrescible) Special Waste (asbestos) for the purpose of off-site disposal. Soil from below 1.2 m would hold the same waste classification if confirmed not to contain ASS, otherwise it would be classified as General Solid Waste (non-putrescible) Special Waste (asbestos), Acid Sulphate Soils. It was further noted that a final waste classification of soils prior to off-site disposal is required.

DP (2020a) found that the elevated concentrations of total and faecal coliform recorded in some of the soil results from adjacent to the buildings and small pool had not been replicated in the groundwater results. This suggested these impacts are relatively immobile and are most likely associated with leakage of underground services associated the site's bathrooms and possibly the use of the small pool by children. It was concluded that removal of the existing structures and sub-surface infrastructure (e.g., pipes) along with the placement of a barrier over these impacted soils (as recommended to address asbestos impacts) would address any potential risk to future site user.

The groundwater results did not indicate significant impact on groundwater quality from the site. Potential chloride impacts in the south-eastern corner of the site are expected to reduce over time following the removal of existing structures and sub-surface infrastructure (e.g., pipes) as part of the works and when the site no longer being used as pool. It was therefore considered that the recorded levels of groundwater contamination are reflective of broader groundwater quality in the area of the site and not limited to impacts from the site. Moreover, notwithstanding, the technical and feasibility constraints that the site presents given its location adjacent to Kogarah Bay, shallow groundwater, deep fill and deep rock profile (more than 32 m bgl in the north-eastern area of the site), it was considered groundwater remediation of the site (which forms a subsection of the reclaimed land within Carss Park / Carss Park Flats) would provide minimal to negligible environmental benefit. Any approach to improving groundwater quality at the site and neighbouring areas should therefore be undertaken at a broader level.

Given the depth that ASS has been encountered, even within the fill (i.e., 1.2 m bgl, ~2.4 m AHD), the disturbance of ASS was not expected to occur during works. It noted that should any materials that are suspected of being potential ASS be disturbed during remedial works these would need to be subject to further ASS testing and possibly (lime) treatment. An ASS management plan would also need to be implemented in this scenario.

Given the proposed open space use of the site, the risk to site users from LFG is not considered to be of significant concern. Further consideration is required to be given to LFG risk should enclosed spaces or services be built / installed. In addition, sub-surface penetration and excavation works should also take into consideration the presence of LFG when undertaking works.

DP (2020a) therefore recommended that:

- A RAP (this report) be developed which details the remedial works required to render the site suitable for the proposed development. The RAP is to include, *inter alia*, an Unexpected Finds Protocol procedure outlining the procedures that would be undertaken in the event that additional unexpected contamination is encountered;
- An asbestos management plan (AMP) is developed prior to commencing works;
- Management of potential exposure to LFG and microbiological (faecal and total coliform) contamination during excavation works is addressed in the site's construction environmental management plan prior to commencing works; and

- A LTEMP is developed on completion of the remedial works for long term management of the site and the LTEMP subject to a notification mechanism (such as on Council's Section 10.7 Planning Certificate).

In summary, DP (2020a) concluded that the site can be rendered suitable for the proposed open space land use subject to development of a suitable RAP (this report), undertaking the remediation works, subsequent validation of these works and the development and implementation of an LTEMP once remediation has been completed.

4.3 DP (2020b)- Hazardous Building Materials Survey

DP (2020b) comprised a hazardous building materials survey of the main building, pump house and general grounds (pools, awnings, irrigation tanks and car park). The report identified the presence of hazardous materials on all properties within the site. These included: asbestos, lead dust; lead paint; PCB; and SMF.

Appropriate management and removal of these hazardous building materials was deemed required during the demolition process for site structures.

4.4 DP (2020c)- Additional Geotechnical Investigation

The additional geotechnical investigation comprised:

- Eight piezocone penetration tests (CPT201 to CPT206) taken to depths ranging from 3.4 m to 32.5 m bgl;
- Six large diameter boreholes (BH101 (G) to BH106 (G)) drilled to depths of between 0.7 m and 1.7 m bgl in the area of the originally proposed car park to investigate the pavement subgrade. Note: these were drilled within 1 m of the contamination boreholes drilled for this DSI (BH101 (E) to BH106 (E)); and
- Six Dynamic Cone Penetrometer Tests (DCPs) taken to depths of up to 3.6 m bgl or prior refusal at test locations BH103 to BH105 in the area of the proposed car park and three extending below the base of the existing pool at BH117 to BH119.

In summary, DP (2020b) encountered the following sub-surface conditions across the site comprising:

- PAVEMENT - In the car park areas only - asphaltic concrete 20-60 mm thick over 0.3 m to 0.6 m of apparently well compacted gravelly sand;
- FILL - Mostly gravelly sand, clayey sand, sandy clay and silty clay, generally loose to medium dense or stiff to very stiff with occasional bands of very loose sand or soft to firm clay. The filling also included plastic, rags, glass, metal, concrete and timber fragments. The filling extended to depths ranging from 1.6 m to 6.0 m bgl;
- SAND - Very loose to loose sand, to depths of about 4.0 m to 6.7 m bgl, encountered only in CPT201, CPT202 and CPT206 to CPT208;
- CLAY - Soft to firm clays, to depths of about 5 m to 6.5 m bgl, encountered only in CPT201 and CPT205 to CPT208;

- CLAY - Stiff to hard clays and silty clays with medium dense and dense sand bands down to the termination depths of all CPTs (5.2 m to 32.5 m bgl) - with the exception of CPT202, CPT203 and CPT204 which terminated within the filling; and
- SANDSTONE BEDROCK - Encountered within three of the previous boreholes (BH01, BH02 and BH06), and inferred to be the cause of refusal of BH105 and some of the CPTU - depths to sandstone bedrock range from 1.6 m to more than 32.5 m bgl.

Test locations are shown on Drawing 2, Appendix A.

Taking into consideration the proposed remediation capping approach and DP's estimates of settlement, DP indicated that a lower level of ground treatment is possible to reduce the settlement by compacting the near surface layers above the water table. Given this DP (2020c) suggested the following site preparation be considered:

- Excavate the existing fill over the whole site to 0.5 m below the proposed finished levels as required for placement of the new fill in accordance with the site remediation strategy (as outlined herein);
- During demolition of the existing pool shell, excavate the sides of the existing pool to form sloping batters with overall slopes not steeper than 1:1.5 Vertical to Horizontal and preferably stepped to allow for compaction of new filling in horizontal layers;
- Compact the exposed subgrade as much as possible using either standard heavy rollers or an impact roller. If the soft clay fill is exposed in any area, then a suggested procedure would be to place a layer of geofabric across the exposed clay and then place and compact the first layer of new fill above the geofabric;
- Preference for imported fill should be given to a well graded granular material such as a ripped sandstone with a maximum particle size of 150 mm;
- Place the new fill in maximum 250 mm thick loose layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction, with moisture contents maintained within 2% of Standard optimum moisture content; and
- Undertake density testing of the fill as it is compacted in accordance with the requirements of AS 3798:2007.

In addition, with respect to reuse of excavated spoil, it is noted from a geotechnical perspective site won material can be used to backfill the pool provided that:

- It contains less than 5% organic matter or foreign materials including wood, plastic or steel;
- Has a maximum particle size of 150 mm; and
- Is compacted to the specifications outlined in DP (2020c).

Reference is to be made to DP (2020b) for further geotechnical information on settlement and site preparation works.

4.5 MT (2020)- Arboriculture Report

Whilst the arboriculture report addressed various issues, most pertinent to this RAP were:

- Retention of Trees 23, 24, 27 and 32 (tree locations are indicated on the civil drawings in Appendix B);
- TPZ for the trees to be retained were between 9.6 m and 13.2 m;
- Any excavation of existing soils within the TPZ is to be to maximum 0.1 m to 0.15 m depth, no closer than 1 m to the trunk and only undertaken with hand tools; and
- Any placed fill within the TPZ is to be free draining, sand based and not high in organic matter.

It is noted that the above requirements have been considered when developing the remediation approach for the site and have generally taken precedence in the final remediation approach to allow tree health to be maintained, whilst not undermining the integrity of the remediation approach (i.e., preventing a complete source - pathway - receptor linkages).

5. Conceptual Site Model

A Conceptual Site Model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future, *viz.* it enables an assessment of the potential source - pathway - receptor linkages (complete pathways).

The CSM presented below is an updated version of the CSM presented in DP (2020a) and is based on the previous assessments as detailed in Section 4. The CSM has been used in determining an appropriate remediation strategy for the site.

5.1 Potential Sources

Based on the current investigation, the following potential sources of contamination and associated contaminants of potential concern (COPC) have been identified.

S1 - Large scale filling of site - Associated with land reclamation and potential uncontrolled waste fill and levelling including imported contaminated fill or residual demolition waste.

COPC include asbestos, chromium, copper, lead, zinc, PAH, TRH and LFG (including methane, carbon dioxide, hydrogen sulphide and carbon monoxide).

S2 - Large scale filling of adjacent (off-site) areas - Associated with land reclamation and potential uncontrolled waste fill and levelling including imported contaminated fill or residual demolition waste.

Copper, zinc, ammonia, LFG (including methane, carbon dioxide, hydrogen sulphide and carbon monoxide).

S3 - Past and current site activities - A potential source of contamination is the use of the site as a swimming pool and uncontrolled release of pool water into the environment and related storage of chemicals.

COPC include heavy metals, chlorine, microbial activity.

S4 - Deterioration of existing buildings.

COPC include asbestos, SMF, lead (in paint and dust) and PCB.

5.2 Potential Receptors

Human Health Receptors:

R1 - Construction and maintenance workers;

R2 - End users (members of the public); and

R3 - Adjacent site users.

Note: Given the site is no longer operational and closed to public access, current site users (other than maintenance workers) are not considered receptors.

Environmental Receptors:

R4 - Terrestrial ecology (upper 2.0 m of the proposed final landform);

R5 - Groundwater; and

R6 - Surface water (Kogarah Bay).

5.3 Potential Pathways

P1 - Ingestion and dermal contact;

P2 - Inhalation of dust, vapours and/or LFG;

P3 - Direct contact with local ecology (upper 2.0 m of the proposed final landform);

P4 - Leaching of contaminants and vertical migration into groundwater; and

P5 - Lateral migration of groundwater providing base flow to water bodies.

Based on the results of DP (2020a) and the generally low chemical contaminant concentrations in the near surface soils, surface water run-off to a receiving water body from the site was not considered to be of concern.

5.4 Summary of CSM

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to the identified receptors from contamination sources on or in the vicinity of the site, via exposure pathways (complete pathways). The CSM for the site is shown in Table 2 below.

Table 2: Summary of Potential Complete Pathways

Source and COPC	Transport Pathway	Receptor	Risk Management Action Recommended
S1 - Large scale filling of site COPC: asbestos, chromium, copper, lead, zinc, PAH, TRH, ammonia and LFG S3 - Past and current site activities COPC: asbestos, chlorine and microbial activity	P1 - Ingestion and dermal contact P2 - Inhalation of dust, vapours and/or LFG P3 - Direct contact with local ecology (upper 2.0 m of the proposed final landform) P4 - Leaching of contaminants and vertical migration into groundwater P5 - Lateral migration of groundwater providing base flow to water bodies	R1 - Construction and maintenance workers R2 - End users (members of the public) R3 - Adjacent site users R4 - Terrestrial Ecology (upper 2.0 m of the proposed final landform) R5 - Groundwater	Excavation of the eastern bund to remove TRH, B(a)P TEQ and asbestos contamination identified in TP124. Capping of the site to address direct exposure to asbestos, lead, chromium and microbial. Removal of site infrastructure, including sub-surface infrastructure (e.g., pipes) to reduce potential future microbial and chloride impacts. Implementation of LTEMP to manage the site in the long term. Implementation of suitable construction management procedures during works.
S2 - Large scale filling of adjacent (off-site) areas COPC: Copper, zinc, ammonia and LFG	P2 - Inhalation of dust, vapours and/or LFG. P5 - Lateral migration of groundwater providing base flow to water bodies	R1 - Construction and maintenance workers R2 - End users (members of the public) R5 - Groundwater	
S4 - Deterioration of existing buildings COPC: asbestos, SMF, lead (in paint and dust) and PCB	P1 - Ingestion and dermal contact P2 - Inhalation of dust	R1 - Current users (members of the public) R2 - Construction and maintenance workers R3 - End users (members of the public) R4 - Adjacent site users	Hazardous materials to be removed in accordance with relevant legislation and guidelines prior to demolition, with the footprints of the buildings validated upon completion of demolition.

6. Remediation Extent and Options

6.1 Area of Environmental Concern

DP (2020a) identified bonded asbestos as being the primary contaminant of concern. It was identified to be present at the majority of the site's sampling locations and at varying concentrations and depths through the fill profile. Moreover, it is noted that FA/AF analysis recorded only minor detections in samples TP120/2.0-2.1 (0.0001 g/ <0.001% w/w) and TP124/4.5-4.6 (0.0021 g/ <0.001% w/w).

With respect to soil chemical contamination the following exceedances are to be remediated and / or further investigated (including delineation) for any development works in the relevant area:

- Chromium in sample TP130/2.7-2.8 due to HIL exceedances;
- Lead in sample BH1/1.5-1.9 (from CS (2019a)) due to HIL exceedance;
- Zinc in sample BH1/1.5-1.9 (from CS (2019a)) due to EIL exceedance;
- B(a)P TEQ in sample TP124/0.8-0.9 due to HIL exceedances; and
- TRH fraction F3 in sample TP124/0.8-0.9 due to ESL exceedances.

It is noted that sample TP124/0.8-0.9 is located in the eastern berm at around 4 m AHD, and hence, would be excavated to reach the proposed bulk earthworks levels.

Regarding the lead and zinc exceedance recorded in CS (2019a), these are located within the TPZ and are at depth. As noted in DP (2020a), given the results in the adjacent (DP, 2020a) test pit (TP130) recorded significantly lower metal concentrations in samples TP130/0-0.1 and TP130/1-1.2 and the potential damage and limitations associated with excavating within the TPZ (i.e., limited to 0.1 m to 0.15 m depth, no closer than 1 m to the trunk and only undertaken with hand tools, refer to MT (2020)), removal of this contamination would be considered to provide an overall negative outcome for the project and hence, it is recommended that this contamination is left in place and managed through capping and a LTEMP.

6.2 Remediation Options

With reference to NEPC 2013, and in consideration of the potential exposure pathways, it is considered that the site can be rendered suitable with respect to the B(a)P, TRH, asbestos, lead, chromium and microbial contamination by either:

A. Excavating all fill from the site in the upper 2 - 3 m that exceeds the SAC as outlined in DP (2020a). Excavated fill to be disposed to landfill;

B. Management of fill at depth through cap and containment so as to minimise future disturbance and exposure. This management strategy would comprise placing the fill (that doesn't exceed the SAC for chemical contaminants) in areas that need to be filled (e.g., footprint of the existing pool) and construction of a capping layer over the impacted soils and preparation of a LTEMP to prevent future inadvertent exposure of the of contamination to site users. Soils that exceed the SAC for chemical contaminants would be disposed to landfill; and

C. Combination of Options A and B, where Option A is adopted for fill requiring excavation to reach design levels and Option B is adopted for fill that remains at and below bulk excavation levels.

In addition, the deeper fill is proposed to be left *in situ* and managed through a LTEMP and local authority notification. The notification would allow the local government authority to record this information in its property system information.

Option C has been selected as the preferred remediation option given:

- The non-volatile nature of the contamination that is to be retained below the bulk earthworks level;
- The NSW EPA objective of minimising waste generation (i.e., disposal of soils to landfill);
- The shallow groundwater level at the site which the contaminated fill extends below. In this regard, disturbance and excavation of fill below the water table has the potential to impact on water quality. Moreover, the feasibility of lowering the groundwater table below the fill level without significant works is limited given the site's location adjacent to Kogarah Bay and the estuarine deposits that underlay the fill;
- The presence of ASS and the requirement to minimise potential impacts on the environment from ASS during works. This is achieved though minimising both the disturbance of the ASS and lowering of the groundwater table;
- The need to consider geotechnical requirements for potential reuse of site won soils (e.g., sorting / sieving) and the associated asbestos risks that would need to be managed during works;
- Minimising the disturbance of fill within the TPZ for retained trees; and
- Management of the deeper fill below 3 m depth is proposed, which therefore already requires the implementation of an LTEMP for the site.

7. Adopted Remediation Strategy and Assessment

The remediation works must be conducted by experienced and appropriately licensed contractors. An experienced environmental consultant is to be engaged to inspect the progress of the works and to provide ongoing advice and recommendations as required. The success of the remediation works will be validated by the Environmental Consultant in consultation with other consultants (e.g., Occupational Hygienist, Asbestos Contractor).

The remediation strategy has not allowed for the construction of sub-surface confined spaces, such as enclosed utility and inspection pits and hence these structures are currently prohibited under the adopted remediation strategy. Further investigation and/or mitigation in design would be required and approval provided by the Environmental Consultant and the Site Auditor prior to any such features being constructed.

7.1 Demolition of Existing Structures (including inground infrastructure)

Initially, appropriate removal and disposal off-site of the hazardous building materials within the existing structures and accessible sub-surface infrastructure is to be undertaken. This will be followed by demolition and removal off-site of the site's structures and sub-surface infrastructure (including ACM pipes).

Following demolition works the footprints of the building are to be inspected by the Environmental Consultant to confirm findings of DP (2020a) and to check for any areas of concern (if present).

Reference is also to be made to the project's demolition and waste management plan (undertaken prior to commencing works) for further information on the demolition works.

Removal of existing structures and sub-surface infrastructure is required to address the potential for a long term source of contamination thought to be contributing to microbial and chloride contaminant loads detected in DP (2020a).

7.2 Disposal of Excavated Site Soils

DP understands that the preferred remedial approach for excavated asbestos contaminated soils is off-site disposal. Disposal would be required where asbestos contaminated soils require removal to meet bulk excavation levels. In this regard, asbestos was detected in the upper soil profile which also contained inclusions of foreign materials (including the eastern bund). Given the need to also remove large inclusions and foreign materials for geotechnical purposes (where present and which may otherwise involve the need to sort / sieve site won soils for re-use), it is considered that the health and safety issues associated with managing asbestos risks on-site from such operations would likely be too onerous.

Excavation and disposal off-site of excavated soils will also address the B(a)P and TRH ESL exceedances recorded in sample TP124/0.8-0.9 located in the eastern bund as outlined in DP (2020a).

DP notes that whilst not currently proposed, consideration could be given to retaining some of the excavated soils during works where low portions of large inclusions, foreign materials, organic matter and contaminants (most notably asbestos) are present. This would therefore limit the remedial works required prior to placement of the site won soils and reduce off-site disposal. Such a process would need to be implemented during construction and would involve a high level of supervision and input from both the environmental and geotechnical consultant.

7.3 Capping of Contaminated Fill

Following excavation of the site to reach bulk earthworks levels, the following capping process is to be implemented across the whole site to address direct exposure risk to asbestos, lead, chromium and microbial contamination in the fill. Drawings 3 to 10 in Appendix A show the general capping approach for the site, existing TPZ areas and deeper planting areas respectively.

The remedial process for the general site is (also refer to Drawing 3, Appendix A):

- As outlined in DP (2020c), following initial earthworks to reach bulk excavation levels compact the exposed subgrade as much as possible using either standard heavy rollers or an impact roller. undertake general earthworks to reach bulk excavation levels;
- Inspection and clearance of the site by the Occupational Hygienist to confirm the absence of ACM at the surface. Visual observation is to be undertaken on a (minimum) 3 m x 3 m cross grid pattern to confirm the absence of any visual identifiable asbestos at the surface. If ACM is observed at the surface this is to be removed by the asbestos contractor and the area reinspected;
- Cover the asbestos impacted fill with a marker layer comprising a geofabic with minimum 200 mm overlap between rolls. The geofabric is to be non woven, durable (minimum 140 gsm with grab tensile strength of 500 N) and of an easily identifiable colour (e.g., orange). DP would consider the Jaybro mastaTEX to be a suitable geofabirc (refer to Appendix D);
- Survey the location (GPS co-ordinates to within 100 mm of its true position) and height (AHD to within 100 mm of its true level) of the capped soils / marker layer to allow a record of the location (vertical and horizontal) to be included in the LTEMP for the site and provide base levels for the capping material. As a minimum, a survey point in the order of every 15-20 m^2 and every 5 m along the site boundary would be suitable. Survey locations and results are to be recorded on a site survey drawing;
- Place a minimum 350 mm thick capping layer comprising virgin excavated natural material (VENM) over the marker layer. Given that leaching of the fill above the water table is not considered to be of significant concern, consultation should be undertaken with the geotechnical engineer and arborist on a suitable type of fill.

  As outlined in DP (2020c):

  - Preference for imported fill should be given to a well graded granular material such as a ripped sandstone with a maximum particle size of 150 mm;
  - Place the new fill in maximum 250 mm thick loose layers and compact to achieve a dry density ratio of between 98% and 102% relative to Standard compaction, with moisture contents maintained within 2% of Standard optimum moisture content; and
  - Undertake density testing of the fill as it is compacted in accordance with the requirements of AS 3798:2007.
- Placement of a 150 mm topsoil layer and turf covering. Extra caution should be used if proposing to use a recycled product (refer to Section 10.3); and
- Survey the location (GPS co-ordinates to within 100 mm of its true position) and height (AHD to within 100 mm of its true level) at approximately the same locations undertaken for the survey post placement of the geofabric. Survey locations and results are to be recorded on a site survey drawing and compared to the initial results to confirm the cap is 500 mm thick. The survey data from both surveys is to be recorded on a site survey drawing and overlayed on a recent aerial image of the site.

For works in the existing TPZ areas reference should be made to the arborist report (MT, 2020) and the civil drawings and works undertaken in collaboration with the arborist and civil engineer. In summary, the above process outlined for capping of the site would apply for the TPZ (Type 2) areas with the following amendments and / or requirements (also refer to Drawing 4, Appendix A):

- Excavation limited to 100-150 mm using hand tools and not within 1 m of the trunk;
- Survey the boundary of the TPZ to show on survey drawings;
- VENM capping is to be a minimum 100 mm thick;
- To minimise potential ponding of water at the base of the tree, fill (VENM / topsoil) is not to be placed within 300 mm of the truck and graded up to final level at a grade of 3(H):1(V);
- Fill (soil) used in the TPZ to be free draining;
- Where the minimum 100 mm VENM layer is placed, 200 mm of topsoil or mulch is also to be placed to make an overall capping thickness of 300 mm;
- Mulch / woodchip (or similar) to be placed in the 300 mm area around base of trunk, but not mounded against the tree trunk, to cover the marker layer; and
- At the interface between the turf and mulch / woodchip areas a 90 mm x 40 mm Integrated Recycling CON920 plastic edge (charcoal colour) with rectangular profile is to be installed to delineate the two areas and assist with retention of mulch within the designated area.

Where deeper planting of new trees is undertaken, these are not to deeper than 1 m from the final surface level or extend below the marker layer (refer to Drawing 5, Appendix A).

For the interface of the capping layer with the eastern boundary, 500 mm wide and 500 mm thick durable sandstone blocks will be placed along the eastern boundary level with the top of the cap. The marker layer geofabric will extend below the base of the sandstone block. This will provide protection to the cap from the adjacent marine environment by acting as a barrier to direct impact and is in addition to the protection/mitigation measures already present (refer to Drawings 6 and 7, Appendix A).

The interfaces between the cap and the southern and western boundaries are shown on Drawings 8 and 9 in Appendix A, respectively. For the southern boundary, the installed cap is to extend 500 mm past the edge of the southern remediation boundary to allow integration between the two areas without compromising the integrity of the capping at the remediation boundary. In this regard a 90 mm x 40 mm Integrated Recycling CON920 plastic edge (charcoal colour) with rectangular profile is to be installed to delineate the edge of the remediation boundary.

With respect to the western boundary, the existing car park with its pavements and stormwater management/drainage network provides an interface with low potential for erosional impact on the cap and hence a simple and easily defined interface. The marker layer is to be secured to the base of the curb.

Concerning the small TPZ (Type 3) area along the northern boundary of the site adjacent to the existing (off-site) footpath and which is within the TPZ of off-site trees, capping in this area above the marker layer will be limited to 150 mm of topsoil. Given the small area and the benefit to tree health by minimising disturbance of the root zone, this is not considered to compromise the integrity of the approach. Notwithstanding, to assist with erosion protection of the topsoil and to provide a further

more rigid barrier, a biaxial (or triaxial) black polypropylene geogrid within minimum rib thickness of 3.4 mm and aperture dimension of 33 mm is to be used. DP would consider the Jaybro mastaGRID 40/40 to be a suitable geogrid (refer to Appendix D). The geogrid is to be installed 75 mm below the surface, extend 500 mm past the edge of the TPZ to the south and have a minimum 500 mm overlap between rolls (refer to Drawing 10, Appendix A).

Where paths, shelters and benches are to be constructed, any in ground structures (e.g., footings, etc.) are to be limited to above the marker layer. This is also to apply to any services trenches (e.g., for the irrigation tank). Should any works require disturbance of soils below the marker layer, this is to be undertaken following consultation with the environmental consultant and the implementation of an agreed construction and validation process.

The above process of controlled placement and compaction of the imported fill will minimise the potential for erosion and degradation of the placed VENM fill and will be further supplemented by the overlying topsoil. Moreover, vegetation (i.e., turfing) coverage of the topsoil and placement of mulch / woodchip within defined delineated areas will provide erosion mitigation controls. This will be further supported by the physical structures that bound the site to the north (concrete footpath), east (sandstone blocks) and west (car park).

Note: Consultation with other relevant project consultants should be undertaken where necessary when implementing the above process (e.g., civil and geotechnical engineers for compactions requirements, arborist for works in TPZ, landscape consultant for landscaping requirements, etc.).

7.4 Remediation Acceptance Criteria

For any materials being imported onto site or areas requiring further validation (e.g., unexpected finds), laboratory results are to be compared to NEPC (2013) health and ecological screening / investigation levels for a recreational / open space land use setting. Table 3 provides a summary of the levels derived from DP (2020a). Reference to DP (2020a) and NEPC 2013 is to be undertaken for greater information on how these levels have been generated.

Table 3: Health Investigation and Screening Levels

Contaminants		HIL C and HSL C - Direct Contact (mg/kg)*	Management Limit for Public Open Space (mg/kg)	EIL and ESL (mg/kg)
Metals	Arsenic	300	-	100
	Cadmium	90	-	-
	Chromium (VI)	300	-	410
	Copper	17,000	-	20
	Lead	600	-	1,100
	Mercury (inorganic)	80	-	-
	Nickel	1,200	-	190
	Zinc	30,000	-	520
PAH	Benzo(a)pyrene TEQ[1]	3	-	33[5]
	Naphthalene	1,900 (HSL)	-	170
	Total PAH	300	-	-
TRH/ TPH	C6 – C10 (less BTEX) [F1]	5,100 (HSL)	700[3]	180
	>C10-C16 (less Naphthalene) [F2]	-	1,000[3]	120
	>C16-C34 [F3]	4,500 (HSL)	2,500	300
	>C34-C40 [F4]	6,300 (HSL)	10,000	2,800
BTEX	Benzene	120 (HSL)	-	50
	Toluene	18,000 (HSL)	-	85
	Ethylbenzene	5,300 (HSL)	-	70
	Xylenes	15,000 (HSL)	-	105
Phenol	Pentachlorophenol (used as an initial screen)	120	-	-
OCP	Aldrin + Dieldrin	10	-	-
	Chlordane	70	-	-
	DDT+DDE+DDD	400	-	180[5]
	Endosulfan	340	-	-
	Endrin	20	-	-
	Heptachlor	10	-	-
	HCB	10	-	-
	Methoxychlor	400	-	-
PCB [2]		1	-	-

Notes: 1 – sum of carcinogenic PAH; 2 – non dioxin-like PCBs only; 3 – BTEXN not to be subtracted ;
4- CRC Care Technical Report No 39 for B(a)P ; 5 – for DDT only.
*Given soil vapour intrusion HSL criteria for open space land use is non-limiting for BTEXN, F1 and F2, these have not been included.

With respect to asbestos concentrations, as per NEPC 2013 *Table 7: Health Screening Levels for Asbestos Contamination in Soil* no asbestos is to be visible at the surface, bonded ACM is to be less than 0.02% and FA/AF are to have a concentration of <0.001%.

8. Regulatory Requirements and Approvals

All works must be conducted in accordance with project planning requirements.

All works must also be undertaken in accordance with the relevant regulatory criteria, including *inter alia*:

- NSW Work Health and Safety Act 2011 (WHS Act);
- NSW Work Health and Safety Regulation 2017 (WHS Regulation);
- NSW Contaminated Land Management Act 1997;
- National Environment Protection Council, National Environment Protection Measures 2013 (NEPC, 2013);
- Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA DoH 2009);
- SafeWork NSW: Code of Practice How to Manage and Control Asbestos in the Workplace July 2020; and
- SafeWork NSW: Code of Practice How to Safely Remove Asbestos July 2020.

The works are considered to be Category 1 remedial works under the State Environmental Planning Policy 55 - Remediation of Land (SEPP55) which require development consent prior to commencing. This RAP and the other reports outlined herein have been undertaken in support of the development application. Prior to commencing works it is foreseen that the following primary approvals and licences will be required:

- Development consent from the planning authority;
- Approval to commence works from the planning authority/certifier under the conditions of development consent;
- Asbestos contractor with a SafeWork NSW Class A licence for the removal of asbestos (refer to Section 9.3); and
- Occupation hygienist with a SafeWork NSW Asbestos Assessor Licence (refer to Section 9.6).

9. Roles and Responsibilities

9.1 Principal

Georges River Council retains the overall responsibility for ensuring that this RAP is appropriately implemented. Georges River Council is to nominate a representative (the Principal's Representative-PR), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP may be conducted by the Principal Contractor on behalf of Georges River Council.

9.2 Principal Contractor

The Principal Contractor (referred to hereon as the Contractor) is foreseen to be the party responsible for the day-to-day implementation of this RAP and shall fulfil the responsibilities of the Principal Contractor as defined by SafeWork NSW. It is noted that the Contractor may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures.

In addition to the implementation of the RAP it will be the Contractor's responsibility:

- To obtain specific related approvals as necessary to implement the earthworks, including for example, permits for removal of asbestos-containing materials, SafeWork NSW notification, etc.;
- To develop or request and review plans to manage site works;
- That all site works and other related activities are undertaken in accordance with this RAP;
- To maintain all site records related to the implementation of the RAP;
- That sufficient information has been provided to engage or direct all required parties, including sub-contractors, to implement the requirements of the RAP other than those that are the direct responsibility of the Contractor;
- To manage the implementation of any recommendation made by those parties in relation to work undertaken in accordance with the RAP;
- To inform, if appropriate, the relevant regulatory authorities, of any non-conformances with the procedures and requirements of the RAP in accordance with the procedures outlined in this document;
- To retain records of any contingency actions;
- On completion of the project, to review the RAP records for completeness and update as necessary; and
- To recommend any modification to general documentation which would further improve the environmental outcomes of this RAP.

9.3 Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos works involving any asbestos impacted soils and building materials and will hold a minimum of Class A licence for the removal of asbestos (issued by SafeWork NSW). The Asbestos Contractor can be the same as the Principal Contractor.

Whilst the detections of asbestos fibres in soils have only been detected in deeper soils within the remediation area which are not proposed to be disturbed as part of the works, DP recommends that the asbestos contractor holds a Class A licence for the removal of asbestos to minimise delays, should friable asbestos be encountered during the remedial works. DP also notes that a Class A asbestos removalist would be required for the demolition works (e.g., friable asbestos identified in the pump house, refer to DP (2020b)).

9.4 Sub-contractors

All sub-contractors will be inducted onto the site and informed of their responsibilities in relation to this RAP as part of this induction. Signing of the site induction is to include agreement by the sub-contractors to abide by the RAP requirements. Where necessary, sub-contractors will also be trained in accordance with the requirements of this document. All sub-contractors must conduct their operations in accordance with this RAP as well as all applicable regulatory requirements.

9.5 Environmental Consultant

The Environmental Consultant will provide advice on implementing this RAP.

The Environmental Consultant will be responsible for:

- Undertaking any required assessments where applicable (e.g., waste classification, asbestos validation sampling, etc.);
- Providing advice and recommendations arising from inspections;
- Reviewing documentation and results provided by the contractor (e.g., surveys, compaction results, proposed materials to be imported); and
- Notifying their client with the results of any assessments and any observed non-conformances in a timely manner.

9.6 Occupational Hygienist

The Occupational Hygienist will provide advice on WHS issues related to any asbestos related works. The Occupational Hygienist will hold a SafeWork NSW Asbestos Assessor Licence, in accordance with the WHS Regulations.

The Occupational Hygienist will be responsible for:

- Preparing the AMP;
- Where appropriate generating the WHS plans and advice on request by the Contractor;
- Undertaking airborne asbestos monitoring;
- Undertaking clearance inspections;
- Asbestos sampling;
- Providing advice and recommendations arising from monitoring and/or inspections; and

- Notifying their client with the results of any assessments and any observed non-conformances in a timely manner.

The Environmental Consultant and Occupational Hygienist can be the same entity.

9.7 Site Workers

All workers on site are responsible for observing the requirements of this and other management plans. These responsibilities include the following:

- Being inducted on site and advised of the general nature of the remediation / environmental issues at the site;
- Being aware of the requirements of this plan;
- Wearing appropriate PPE;
- Only entering restricted areas when permitted; and
- Requesting clarification when unclear of requirements of this or any other plans (e.g., SWMS).

10. General Site Management

This section provides general information which is to be considered during the remedial works. Detailed information for the asbestos associated works, *inter alia*, on site management of asbestos materials, monitoring, documentation and roles and responsibilities are to be outlined in the AMP which is to be completed by the Occupational Hygienist prior to commencement of site works.

10.1 Stockpiling of Asbestos Impacted Soils

It is envisaged that temporary stockpiles may be formed during the fill removal / placement. Stockpiles must be managed to minimise the risk of dust generation and erosion given the likely presence of asbestos in the stockpiled materials sourced from the site. The measures required to achieve this include:

- Restrict the height of stockpiles to reduce dust generation (less than 2 m);
- Place site won stockpiles in areas yet to be validated;
- Construct erosion and sediment control measures;
- Cover stockpiles impacted by asbestos at the end of each day or when not in use with plastic or geofabric. Plastic / geofarbic is to be securely weighted down to ensure it is not blown away by strong winds;
- Keep temporary stockpiles moist (not wet), by using water spray where required; and
- Removal of stockpiles to landfill where odours are being generated.

Imported materials are to be placed as separate stockpiles and demarcated to maintain clear and distinct segregation between these and asbestos impacted stockpiles.

10.2 Waste Disposal

All off-site disposal of soils is to be undertaken in accordance with the *Protection of the Environment Operations* (POEO) Act and the NSW EPA *Waste Classification Guidelines,* 2014. Copies of all necessary approvals from the receiving site shall be given to the PR prior to any contaminated material being removed from the site. A preliminary waste classification has been provided in DP (2020a).

It is noted that ASS was detected within the shallower fill profile at TP121 in the north-western area of the site at 1.2 m bgl (~2.4 m AHD). Should these soils or any other soils be suspected of being potential ASS be disturbed during remedial works these would need to be subject to further ASS testing to confirm ASS absence/presence and hence allow waste classification under Part 4 of EPA (2014).

The sampling rate for validation / waste classification / assessment of stockpiled soils is (note that actual frequency will be determined based on volume, contamination risk and homogeneity of the material):

- Stockpiles ≤250 m^3: 1 sample per 25 m^3 and a minimum of 3 samples; and
- Stockpiles >250 m^3: 1 sample per 100-250 m^3 and a minimum of 3 samples.

If contaminated soils are stockpiled in areas other than on existing fill within the site, the footprint of the stockpile is to be validated following removal of the contaminated soils.

During excavation or stockpiling, but prior to loading out, the waste material is to be periodically inspected (and sampled if required) by the Environmental Consultant to confirm the waste classification of the material.

No soil is to leave the site without a formal waste classification report. Transport of spoil shall be via a clearly delineated, pre-defined haul route. Copies of all consignment notes for the transport, receipt and disposal of all materials are to be maintained as part of the site log and made available to the Environmental Consultant for inspection and reporting purposes upon request. It is noted that any asbestos waste / asbestos impacted soil transported in NSW weighing more than 100 kg or consisting of more than 10 m^2 of asbestos sheeting in one load is required to be recorded utilising the NSW EPA tool, WasteLocate.

All relevant analysis results, as part of waste classification reports, shall be made available to the Contractor and proposed receiving site / waste facility to enable selection of a suitable disposal location.

10.3 Importation of Soil

Any soils (including topsoil) imported are to be classified as VENM, or must be compliant with an appropriate Resource Recovery Order (RRO) and associated Resource Recovery Exemption (RRE). All imported material classifications are to be supported by the relevant chemical and physical testing results and, at a minimum, include analysis for heavy metals, TRH, BTEX, PAH, PCB and asbestos.

VENM is to be sampled for each source site at a minimum rate of 3 samples for the first 1,000 m^3 and then 1 sample per 1,000 m^3 thereafter.

As a default requirement for non-VENM materials imported under an RRO/RRE, material supplied to the site is to be sampled by the Environmental Consultant for heavy metals, TRH, BTEX, PAH, PCB and asbestos at the following rate (for each source site):

- Less than 500 tonnes - 3 samples;
- 500 < 1000 tonnes - 4 samples;
- 1,000 < 2000 tonnes - 5 samples;
- 2,000 < 3,000 tonnes - 7 samples; and
- 3,000 - 4,000 tonnes - 10 samples.

Variation to the default requirements outlined above would be subject to the level of documentation provided by the source site and approval of the Environmental Consultant and the Site Auditor.

Notwithstanding the above, all non-VENM materials are to be compliant with the relevant Resource Recovery Criteria (RRC) and requirements of the RRO / RRE.

Furthermore, results are to be compared against the Remediation Action Criteria (RAC) outlined in Section 7.4 where applicable. Note, where there is a difference between the RAC and the RRC, the more conservative criteria are to be adopted.

Prior to importation appropriate documentation confirming the classification needs to be provided to, and approved by, the Environmental Consultant. If necessary, the material is to be inspected at the source site (and sampled if required) to confirm the classification given and to confirm that there are no signs of contamination.

The material must be inspected during importation by the Contractor, and any materials not meeting the description given in the provided documentation or displaying signs of contamination are to be rejected. The Environmental Consultant is to conduct periodic inspection(s) during and / or following importation to check the same. Additional testing of the imported material may be required, as recommended by the Environmental Consultant, commensurate with the documentation and the material type / classification.

DP notes that generally materials imported under a RRO / RRE present a higher contamination risk, hence, extra caution should be used if proposing to use a recycled product.

11. Validation Plan

11.1 Data Quality Objectives and Indicators

The validation assessment is to be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance / Quality Control (QA / QC) procedures to ensure the repeatability and reliability of the results.

The validation assessment will be planned in accordance with the following DQOs:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with NEPM (2013) Schedule B2 is to be completed as part of the validation assessment. The DQIs are:

- Documentation completeness;
- Data completeness;
- Data comparability and representativeness; and
- Data precision and accuracy.

Based on a fulfilment of the DQOs and DQIs an assessment of the overall data quality is to be presented in the validation assessment report.

11.2 Site Inspections

The Environmental Consultant is to conduct periodic site inspections during each phase of the remediation works (e.g., end of bulk earthworks, placement of marker layer, placement of cap) and when any issue of concern is identified. A record of the inspections and observations is to be provided as part of the Validation Assessment Report. This is to include a photographic record.

11.3 Validation Inspection and Sampling

Remediation of the site is considered complete when demolition and disposal off-site of the existing site structures (including sub-surface infrastructure), disposal off-site of excess soil, and subsequent placement of the cap over the retained fill has taken place.

Validation inspections for remediation are to be undertaken during post stripping and stockpiling of the fill, during placement of the fill in the excavation, following installation of the marker layer and on completion of the capping layer.

When inspecting areas for the presence of asbestos (i.e., prior to marker layer placement, in the TPZ areas), this is to be undertaken on a 3 m x 3 m cross grid pattern to confirm the absence of any visible asbestos at the surface.

If validation (soil) sampling is undertaken (e.g., due to unexpected finds) then the sampling rate adopted by the Environmental Consultant is to be reflective of the works being assessed. In this regard, reference is to be made to the NSW EPA *Sampling Design Guidelines 1995* for general validation of areas.

Any inspection requirements for the Occupational Hygienist are to be outlined in the AMP.

Results of the validation sampling (for soils to be retained on site or imported) are to be compared to the RAC, as outlined in Section 7.4.

11.4 Documentation Requirements

The following documents will need to be reviewed in conjunction with those outlined in the AMP as part of the validation assessment by the Environmental Consultant. These are to include and be provided to the Environmental Consultant by the relevant parties.

- Any Licences and Approvals required for the remediation works;
- Waste classification reports;
- Transportation Record: comprising a record of all truck-loads of soil entering or leaving the site, including truck identification (e.g., registration number), date, time, load characteristics (i.e., classification, on-site source, destination);
- Disposal dockets: for any soil disposed off-site. The contractor will supply records of: transportation records, spoil source, spoil disposal location, receipt provided by the receiving waste facility (where available), a record of receipt from the receiving site will be supplied (i.e., the receiving sites transportation records). Note: A record of the building materials disposed off-site is also be kept and provided to the Principal on request;
- Imported materials records: records for any soil imported onto the site, including source site, classification reports, inspection records of soil upon receipt at site and transportation records;
- Records relating to any unexpected finds and contingency plans implemented;
- Incident Reports: any WHS or Environmental Incidents which occur during the works will be documented and the PR and appropriate regulatory authority will be informed in accordance with regulatory requirements;
- Laboratory certificates and chain-of-custody documentation;
- Letters / memos as required to provide instruction or information to the Principal and Contractor;
- Airborne asbestos monitoring records;
- Asbestos clearance comprising visual inspection and validation sampling and analysis;

- Asbestos removal records;
- Inspections records from the Environmental Consultant and Hygienist; and
- Surveys: pre- and post-capping construction showing areas where asbestos impacted soils are located and capped and TPZ areas. These surveys are to be overlayed on a recent aerial image of the site.

11.5 Validation Reporting

A validation assessment report is to be prepared for the site by the Environmental Consultant consistent with NSW EPA *Contaminated Land Guidelines: Guidelines for Consultants Reporting on Contaminated Land* (EPA, 2020) and other appropriate guidance documentation.

The validation report shall describe the remediation approach adopted, methodology, results and conclusion of the assessment and make a clear statement regarding the suitability of the site for the proposed land use a recreational open space park. It is also to provide details of any ongoing (post construction / long term) environmental management (an LTEMP) which is required in order to maintain the remediation system for the retained fill on the site (i.e., ensure the integrity of the capping system over time).

12. Sample Collection and Analysis Requirements

12.1 Field Methods

When required, the following general sampling methodology is to be implemented for all soil sampling:

- Preparing records of samples, including sample date, location, description, signs of concern, and any field results;
- Sampling from surface or from the utilised plant using disposable sampling equipment or stainless steel hand tools;
- Decontaminating all re-useable sampling equipment prior to collecting each sample using a 3% solution of phosphate free detergent (Decon 90) and distilled water;
- Transferring samples into a sealable plastic bag. For asbestos analysis, placement in a second plastic bag / sealed container, such as an esky (i.e., double bagging);
- Transferring samples into laboratory-prepared glass jars with Teflon-lined lid, and capping immediately (for chemical analytes);
- Labelling sample containers with individual and unique identification, including project number and sample number;
- Placing the glass jars for chemical analysis into a cooled, insulated and sealed container for transport to the laboratory (cooling not required for asbestos samples); and
- Using chain-of-custody documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

12.2 Laboratory Analysis

Laboratory analysis of any samples relevant to the validation report is to be undertaken by laboratories with NATA accreditation for the analyte being tested and with appropriate QA / QC assessment. It is noted that FA/AF and 10 L bulk sample asbestos analysis as per NEPC 2013 is not a NATA accredited laboratory test and hence is exempt from this requirement.

At least two laboratories will be required to undertake the testing, a primary laboratory, and secondary laboratory which will analyse inter-laboratory replicate samples. In this regard replicates are to be analysed at a rate of 1 replicate sample per 10 primary samples. At least 50% of the replicates are to comprise inter-laboratory analysis.

Samples are to be analysed for the contaminants of concern identified for the sampling purpose. These contaminants are to be identified based on available laboratory results from previous testing, field observations and the objective of the analysis (e.g., samples from imported material analysed as per Section 10.3).

13. Environmental Management During Remediation and Construction

The Construction Environmental Management Plan (CEMP) is to be followed in conjunction with any other environmental management protocols stipulated in relevant SafeWork NSW, Australian Standard, and / or Council requirements. The CEMP shall be undertaken by the Principal Contractor with input from other contractor(s) and consultant(s) where required. As a minimum, the site-specific CEMP shall detail the following:

- Works sequence and timeline;
- Health and Safety Protocols;
- Dust minimisation measures;
- Noise minimisation measures;
- Environment protection measures;
- Equipment to be used;
- Nominated landfill(s);
- Truck movements / site access / site egress;
- Proposed source(s) of materials for import, and methods of certification;
- Method(s) for surveying before and after physical barrier construction;
- Measures to prevent cross contamination between areas being remediated (capped) and those already capped; and
- Method(s) for inspecting and certifying construction of the physical barrier systems, including any hold points (*may be organised and commissioned by the Principal*).

The remediation and construction works shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The successful contractor shall have in place the site specific CEMP such that work on the site complies with the requirements as laid down in relevant legislation, guidelines and codes.

The contractor shall also be responsible to ensure that the site works comply with the following conditions:

- Fugitive dust leaving the confines of the site (including asbestos fibres) is mitigated;
- No water containing any suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- Vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas; and
- Noise and vibration levels at the site boundaries comply with the legislative requirements.

The appointed remediation and construction contractors will be provided with a copy of DP (2020a) this RAP so that they are aware of the contamination status of the soils and the remediation methodology to be adopted.

The following sub-sections provide details of the environmental management practices to be employed as a minimum at the site in order to minimise and / or prevent environmental impact as a result of the remediation and / or construction works. Again, it is noted that other statutory requirements must also be followed.

The following is intended for the period during development of the site. A separate environmental management plan for long-term management of the site will be required following completion of works.

13.1 Site Delineation

Each stage of remediation and construction is to be appropriately fenced off from the remainder of the site. The fencing will be designed to:

- Prevent unauthorised entry to the work site;
- Minimise the potential for cross contamination between areas already remediated and areas still requiring remediation; and
- Capture and contain minor dust generations.

The fencing alignment applicable to each stage of works will be included in the CEMP.

13.2 Dust Control

Given asbestos has been identified on the site it is important to mitigate risk through appropriate dust control measures and that such measures are adhered to. Generation of dust, therefore, is to be kept to a minimum at all times.

During working hours, water sprays are to be used to keep the surface of any works areas and stockpiled soils (which will be kept to a minimum) reasonably damp, in order to suppress any dust. Water used for dust suppression is to be only the minimum required to reduce dust generation and must not to be allowed to escape the confines of the works areas. If excessive dust is being generated, works are to cease until the dust is sufficiently suppressed.

In summary, the following dust control procedures are to be employed to comply with this requirement as necessary:

- Ceasing works during periods of high winds (i.e., winds that can generate dust);
- Erection of dust screens around the perimeter of the site;
- Securely covering all loads entering or exiting the site;
- Use of water sprays across the site to suppress dust;
- Covering of all stockpiles remaining onsite at the end of each day or when not in use with geofabric or plastic;
- Keeping excavation and stockpile surfaces moist; and
- Regular checking of the fugitive dust to ensure compliance. Immediately implement measures to rectify any cases of fugitive dust.

Whilst air monitoring is not technically required when handling/exposed soils impacted by bonded ACM, DP would consider the implementation of asbestos air monitoring during works involving disturbance of the asbestos impacted soils as a prudent approach to site management.

Air monitoring should be undertaken in consultation with and as directed by the Occupational Hygienist. Air monitoring devices are to be kept at locations nominated by the appointed Occupational Hygienist, which will generally be at the works area boundaries. If asbestos fibres are detected during the course of the works above acceptable limits, the remediation works will cease and dust prevention measures improved. The air monitoring program to be implemented is to be outline in the AMP.

13.3 Soil / Sediment Containment

Industry standard sediment control measures (such as outlined in the 'blue book'), including sediment fencing and / or hay bales, shall be installed where there is a potential for sediment to spill onto neighbouring areas, the car park, roads, stormwater drainage lines or Kogarah Bay.

The sediment control measures shall be regularly inspected and maintained by the Principal Contractor (site foreman).

13.4 Noise Management

Noise impacts will generally result from the excavators, truck movements and construction equipment within the site and surrounding streets, all of which have noise levels within levels normally expected at a construction site.

In order to minimise noise impacts during the remediation works, the following measures are to be implemented:

- Construction noise is to be confined to the hours stipulated by Council. No machinery / trucks are be permitted to access the site outside these hours of operation;
- Signage at the site entrance providing contact details for the site superintendent, so that noise complaints can be readily addressed;
- Establishment and monitoring of a complaints log;
- All equipment and machinery are to comply with regulatory standards for noise generation;
- Fitting mobile equipment with exhaust mufflers, when and if required; and
- Adopting traffic management measures to reduce noise.

13.5 Odour Control

In order to control odours at the site boundaries, the following processes are to be adopted:

- All plant and equipment exhaust levels are to be monitored by the site foreman to ensure acceptable levels. If unacceptable levels are determined, the equipment is to be replaced or repaired;
- If strong hydrocarbon odours are detected from any of the machinery a hydrocarbon mitigating agent is to be used;
- A complaints register is to be set up on-site for recording complaints from residents or tenants, with respect to odours or dust. The complaints register is to be completed by the Site Superintendent, as well as the corrective actions implemented; and
- Once a complaint is received, the site superintendent is to implement a corrective action to rectify any problems associated with the odour or dust source.

Investigations performed to date have not identified significant concentrations of volatile contaminants in the soil, therefore, odours are not anticipated or expected to be significant. If, however, odours are detected during the works the following protocol will be applied:

- Odour source and type of odour to be investigated by the Environmental Consultant. This could include air monitoring or sampling of any suspect media in addition to observations of physical conditions;
- Temporary covering of the source to mitigate odour release whilst waiting for monitoring / analytical results. This could include the temporary reinstatement of ground conditions; and
- Assessing more permanent ways of dealing with the issue. This may include disposal of odorous material off site, the use of masking agents or the controlled progressive excavation.

The re-use of odorous soils for construction purposes will not be undertaken unless the material has been aerated or suitably treated and the odorous material assessed to be suitable and the odour to have adequately attenuated.

13.6 Landfill Gas

Appropriate monitoring and associated management procedures / protocols are to be implemented during the construction works to address work health safety issues associated with the presence of LFG. Particular focus should be given areas that haven't been disturbed and allowed to naturally ventilate.

In this regard, with respect to the safety of site personnel, concentrations for LFG within the works area are to be checked (as deemed appropriate) using hand held monitoring instruments and are not to exceed the following criteria:

- Methane: 0.5% v/v;
- Carbon dioxide: 0.5%;
- Carbon monoxide: 10 ppm;
- Hydrogen sulphide: 30 ppm;
- Volatile organic compounds: 25 ppm; and
- Oxygen: 19.5-23.5% v/v (range).

If one or more of the above criteria are exceeded the area is to be evacuated whilst ventilation of the area takes place until all criteria are re-established below acceptance levels. The time, date, location and LFG concentrations are to be recorded when the criteria is exceeded.

Whilst not anticipated, should a confined space environment be present during the works, reference should also be made to relevant SafeWork NSW regulations and guidelines on working in confined spaces.

Additionally, WHS protocols are to be put in place to address the potential for LFG odours should this be encountered (e.g., provision for masks with organic filters).

13.7 Acid Sulphate Soils

Whilst ASS is not expected to be disturbed by the proposed works, should any materials that are suspected of being potential ASS be disturbed during remedial works these would need to be subject to further ASS testing and possibly (lime) treatment. An ASS management plan would also need to be implemented in this scenario.

ASS screening is to be undertaken on excavated soils that:

- Are from below the water table; or
- Have a sulfurous odour; or
- Are located below 2.4 m AHD, are from an area where ASS assessment has not been undertaken and are dark grey and brown and include more than 15% clay (i.e., more than trace clay) and may have a hydrocarbon odour.

14. Worker Health and Safety

A site specific WHS Plan is to be prepared by the appointed Principal Contractor in consultation with other contractors and submitted for approval by the Principal. Further information on the WHS requirements for addressing asbestos related works associated with the remediation is to be outlined in the AMP.

15. Unexpected Finds Protocol

15.1 Unexpected Finds Protocol

All site personnel are to be inducted into their responsibilities under this Unexpected Finds Protocol (UFP), which is to be included in the Contractors Site Management Plan.

All site personnel are required to report unexpected signs of environmental concerns to the Site Manager if observed during the course of their works e.g., unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the contractor is to, as soon as practical:

- Place barricades around the affected area and cease work in that area;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g., fire brigade);
- Notify the PR of the occurrence;
- Notify any of the authorities that the Contractor is legally required to notify (e.g., NSW EPA); and
- Notify the Environmental Consultant.

The PR is to notify any of the authorities which the Principal is legally required to notify (e.g., NSW EPA).

Following the immediate response in the UFP a contingency plan is to be implemented.

15.2 Contingency Plan

The contingency plan for the site is as follows:

- The Environmental Consultant (or Hygienist as appropriate) to inspect the issue of concern and determine the nature of the issue and the appropriate approach to assessing or (if appropriate) managing the issue;
- Principal Contractor (and if required Georges River Council) is to be informed, if considered necessary, of the proposed assessment and/or management approach;
- The Environmental Consultant (or Hygienist as appropriate) to undertake an assessment considered necessary to determine the management strategy for the area;

- If contamination is found and remediation action (not specified herein) is considered necessary, a remediation strategy for the area is to be prepared by the Environmental Consultant and provided to the Principal Contractor and Site Auditor for approval; and
- If the area or proposed remediation strategy is significantly different than that detailed in this RAP, the Consent Authority or Private Certifier (as appropriate) and Site Auditor is to be provided notification of the proposed works.

16. Conclusions

It is considered that the site can be rendered suitable for the proposed development subject to appropriate remediation, management and site validation in accordance with this RAP.

The successful completion of the remediation is to be validated and reported as outlined herein.

The Environmental Consultant is to be informed if there are any changes to the remediation approach and if so this RAP must be updated in consultation with the relevant parties.

17. Future Requirements - Environmental Management Plan

On completion of the works a post LTEMP is to be developed for the site. This is to outline the management practices to be implemented to prevent damage or degradation of the capping layer and hence protect its integrity. It is also to outline processes to repair and make good the capping in the event of planned or inadvertent breaches such that related risks are mitigated and that any potential exposure of the contaminated soils to site users is minimised.

Requirements for the LTEMP are set out in the NSW EPA *Guidelines for the NSW Site Auditor Scheme (3nd Edition), October 2017*. In summary, the LTEMP is required to be able to be made legally enforceable, developed by a suitably qualified Environmental Consultant and reviewed and agreed with the Site Auditor and Georges River Council. With respect to a mechanism for legal enforcement, DP understands that Council foresee one approach to this being through a condition of the development consent. On agreement by all parties to the LTEMP, appropriate public notification of the plan for the site is to be undertaken, typically this involves Council notifying the presence of the EMP on the site's Section 10.7 Planning Certificate.

18. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Kogarah War Memorial Swimming Pool in general accordance with DP's proposal SYD200681 dated 1 July and acceptance received from Michael Baker of SJB Planning Pty Ltd on behalf of SJB Architects Pty Ltd. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of SJB Architects for this project only and for the purposes as described in the report. It may also be used by Georges River Council under the same DP Conditions of Engagement. It should not be used

by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This RAP has been prepared based on the results of previous investigations at the site and the proposed works. Should site conditions encountered during works differ from those currently understood and as outlined in this report, or the proposed construction works be altered, or the remedial approach amended without DP's knowledge and agreement, this RAP would no longer be valid for remediation of the site.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific testing locations in the cited reports, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during previous investigations. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond these previous testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached notes and referenced reports should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

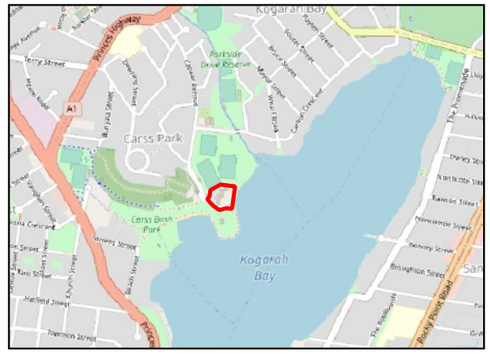
The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

Douglas Partners Pty Ltd

Appendix A

Drawings

About This Report



LOCALITY MAP

Notes:
1. Basemap from nearmap.com (dated 01/06/2020)

Legend

Approximate Site Boundary (Remediation Boundary)

0 15 30 45 m

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	SJB Architects		
OFFICE:	Sydney	DRAWN BY:	NW
SCALE:	1:700 @ A3	DATE:	28.09.2020

TITLE: **Site Location (Remediation Area)**
Kogarah War Memorial Pool
Carss Park

N

PROJECT No:	99751.00
DRAWING No:	R.002 - 1
REVISION:	1

Notes:
1. Basemap from nearmap.com (dated 01/06/2020)
2. Test locations shown are approximate only

Legend

- Approximate Site Boundary (Remediation Boundary)
- Approximate Location of Previous Shoreline

Previous Test Locations

- CPT Locations (DP, 2018)
- Borehole Locations (DP, 2018)
- Geotechnical Investigation (Construction Sciences, 2019)

Test Locations (DP, 2020)

- Env/ Geo Boreholes
- Test Pits
- Monitoring Wells
- Hand Augers
- CPTs

0 15 30 45 m

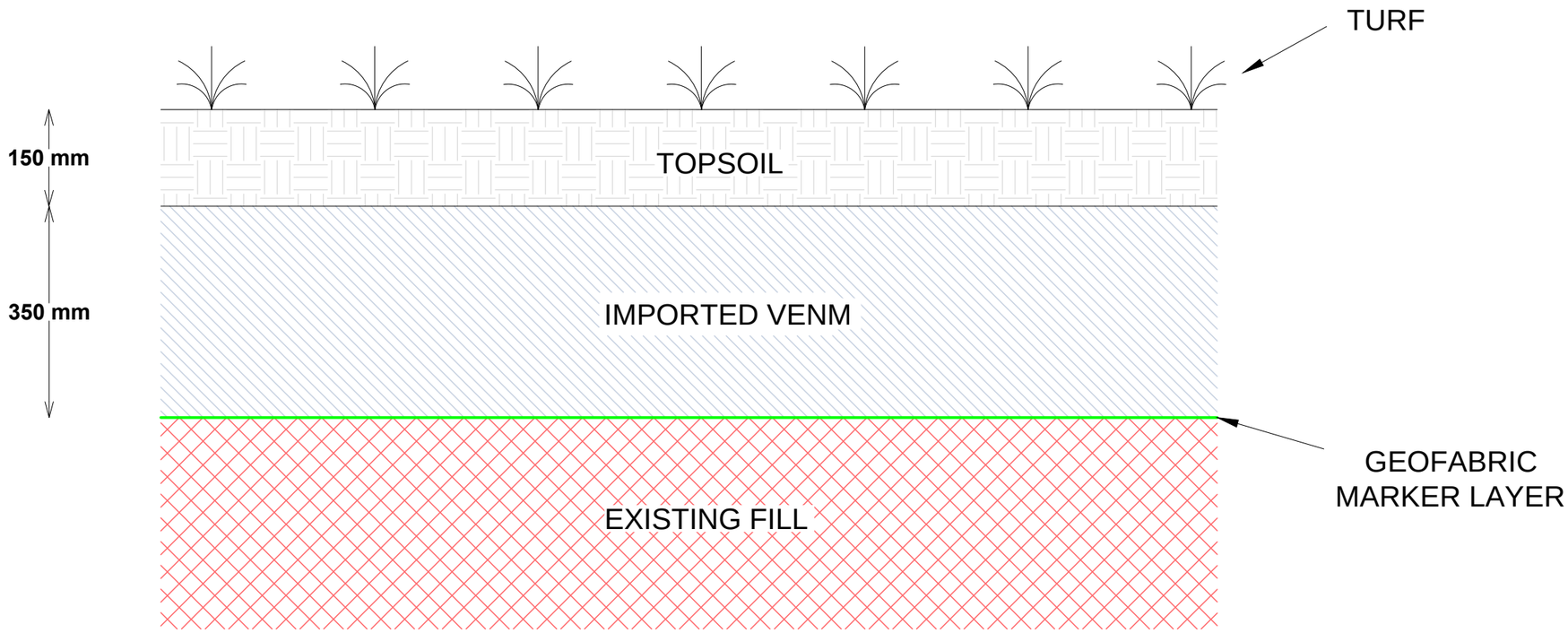
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	SJB Architects		
OFFICE:	Sydney	DRAWN BY:	NW
SCALE:	1:700 @ A3	DATE:	28.09.2020

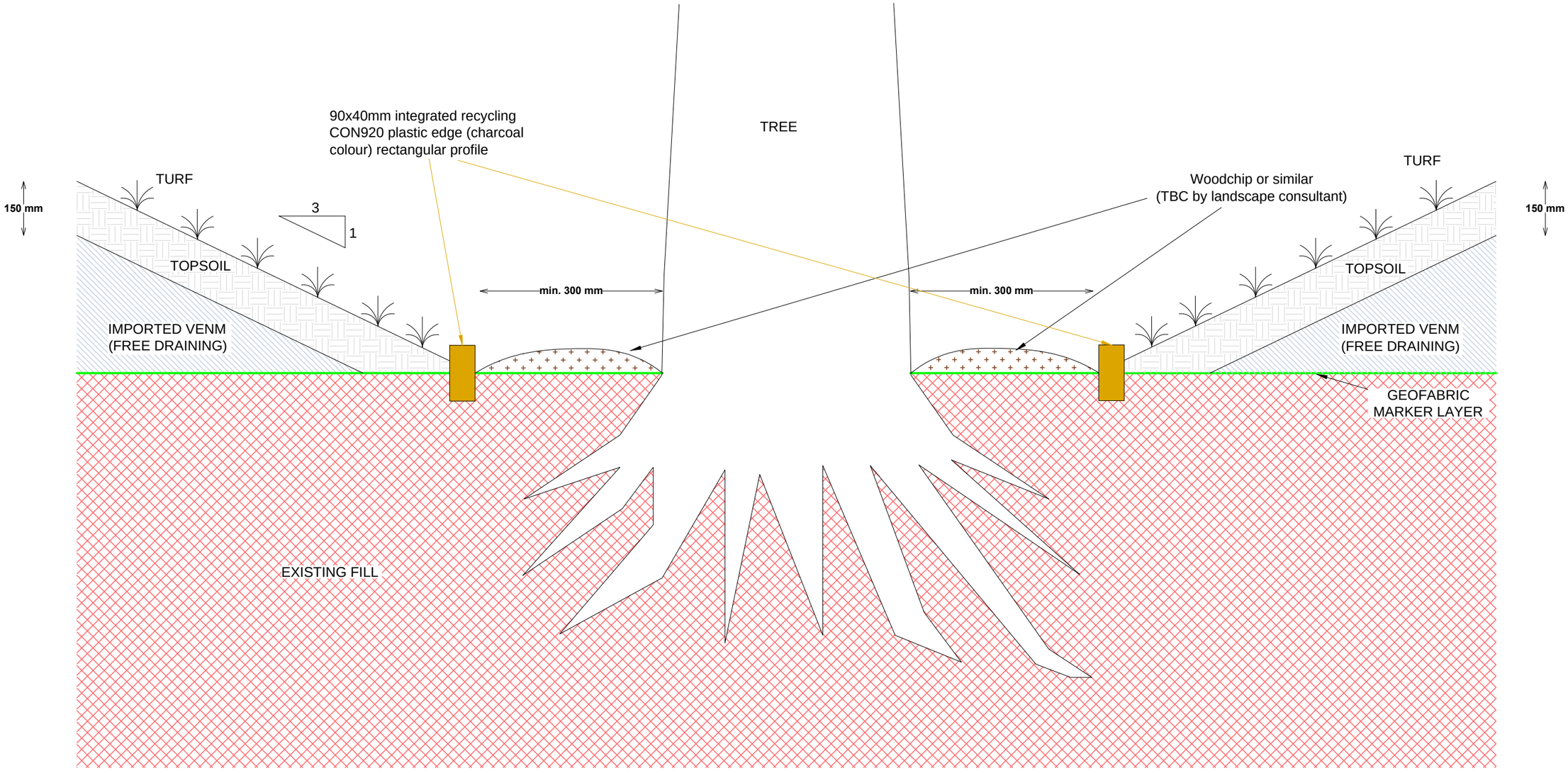
TITLE: **Previous Test Locations**
Kogarah War Memorial Pool
Carss Park

N

PROJECT No:	99751.00
DRAWING No:	R.002 - 2
REVISION:	1

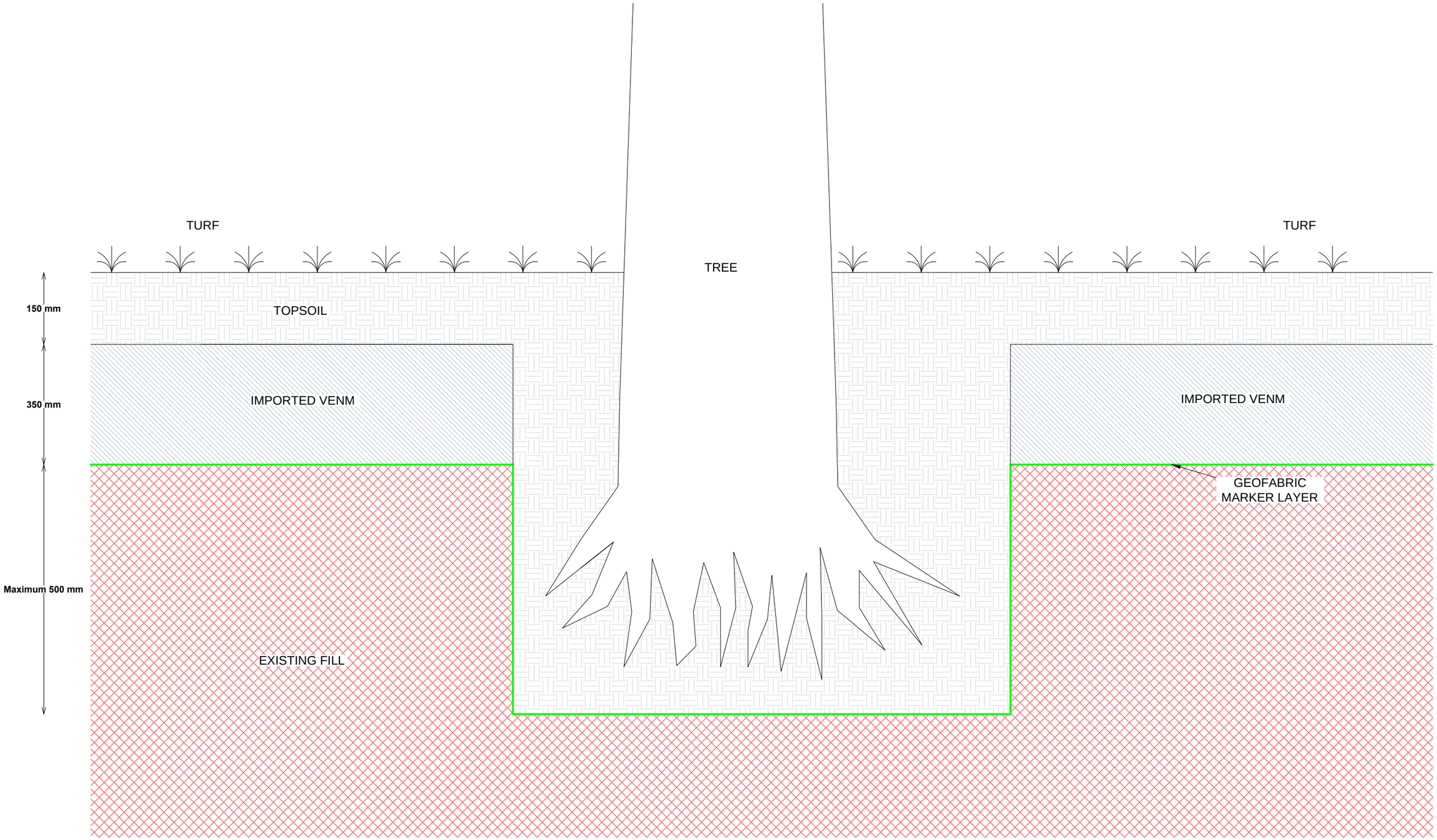


Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects	TITLE: **Remediation Approach - Capping Strategy** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney / DRAWN BY: JDB		DRAWING No: R.002 - 3
	SCALE: N.T.S / DATE: 21.8.2020		REVISION: 0



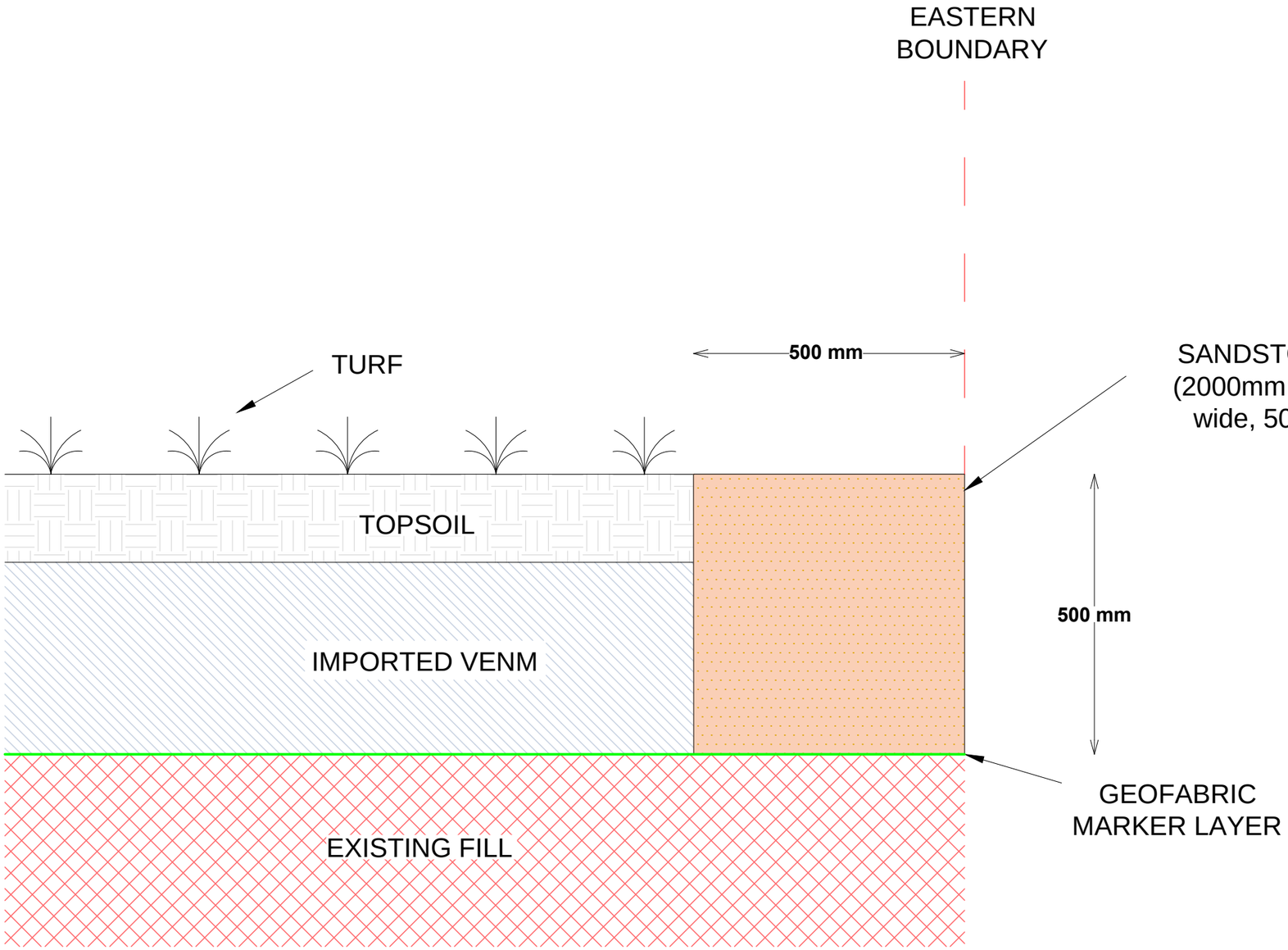
NOTE: - Works to be confirmed with arborist and landscape consultant prior to commecing
- If required, existing fill greater than 1 m from the trunk may be removed using hand tools to 100-150 mm deep. This is to be undertaken in consultation with the arborist.
- Refer to civil drawings for final capping thickness in Tree Protection Zones.

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects	TITLE: **Remediation Approach - Existing TPZ Areas** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney DRAWN BY: JDB		DRAWING No: R.002-4
	SCALE: N.T.S DATE: 24.9.2020		REVISION: 2



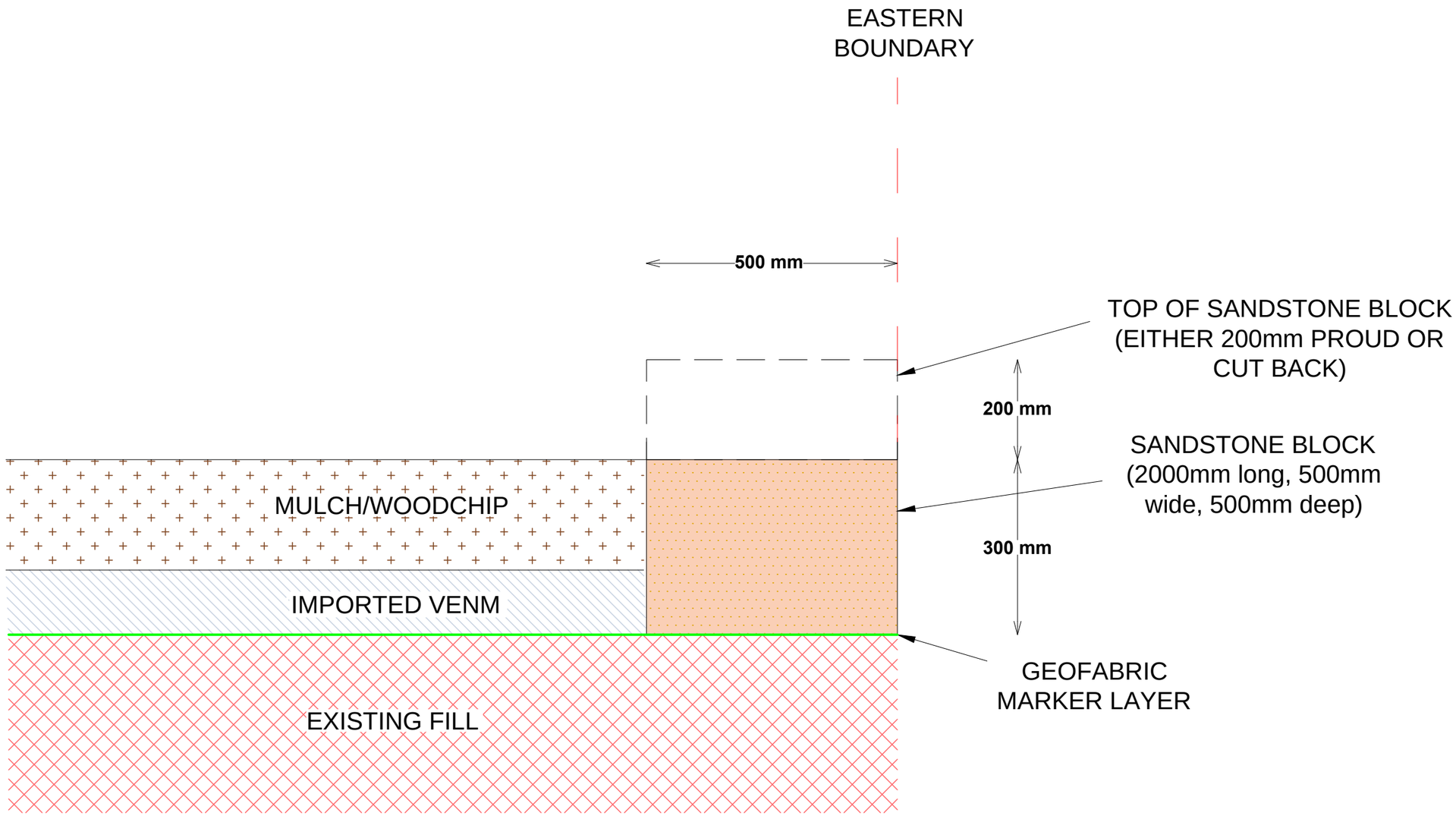
NOTE: Width and length of deeper topsoil area to be confirmed with arborist and landscape consultant

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects	TITLE: **Remediation Approach - Deeper Tree Planting** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney DRAWN BY: JDB		DRAWING No: R.002-5
	SCALE: N.T.S DATE: 11.9.2020		REVISION: 0

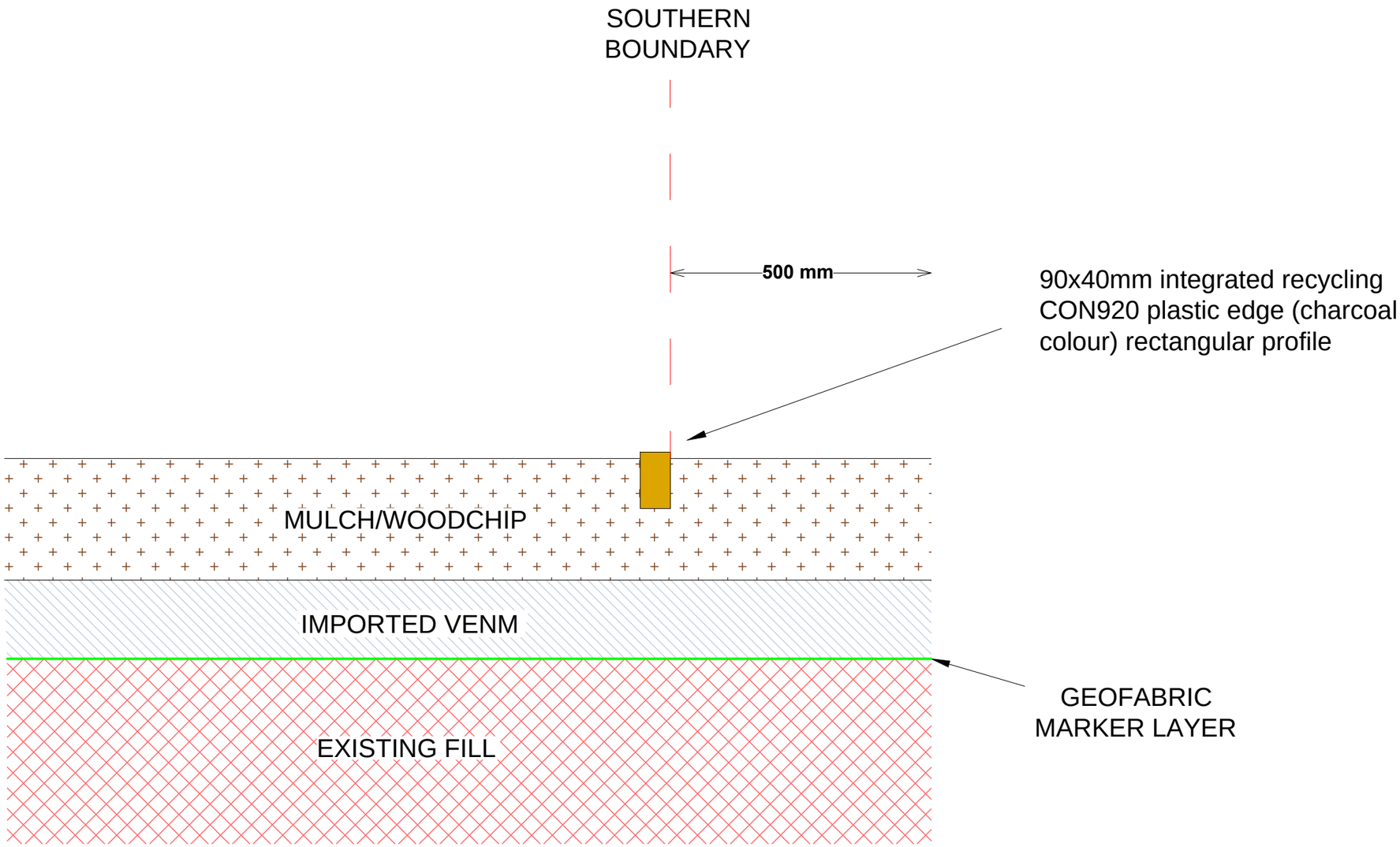


Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SJB Architects		TITLE: **Capping Approach - Eastern Boundary**	PROJECT No: 99751.00
OFFICE: Sydney	DRAWN BY: JDB	**Kogarah War Memorial Pool**	DRAWING No: R.002 - 6
SCALE: N.T.S	DATE: 24.9.2020	**Carss Park**	REVISION: 0

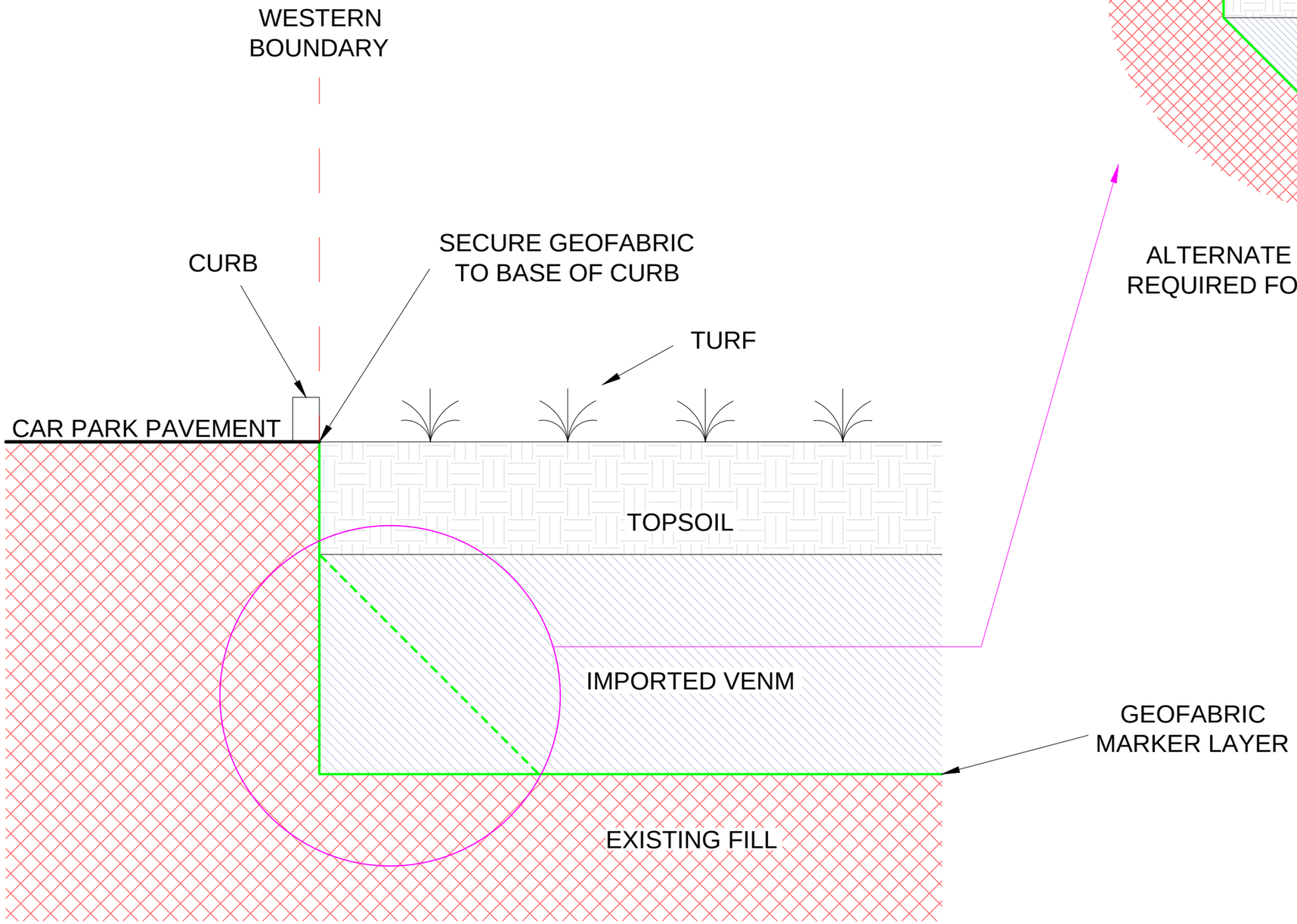


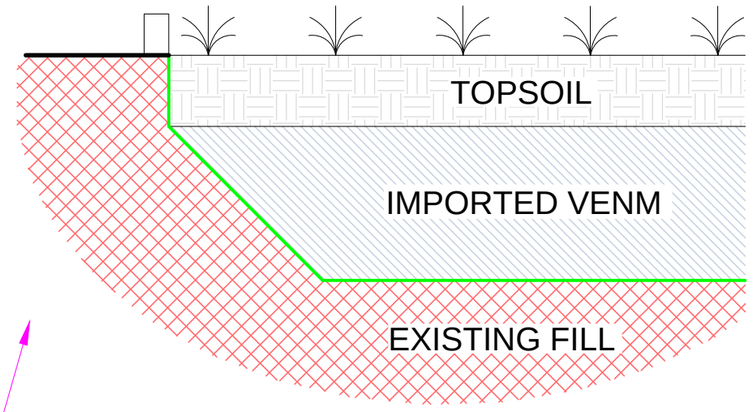
Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects		TITLE: **Capping Approach - Eastern Boundary within TPZ (Type 2)** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney	DRAWN BY: JDB		DRAWING No: R.002 - 7
	SCALE: N.T.S	DATE: 24.9.2020		REVISION: 0



NOTE: Works not to extend into Carss Cottage state heritage listing curtilage

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects		TITLE: **Capping Approach - Southern Boundary within TPZ (Type 2)** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney	DRAWN BY: JDB		DRAWING No: R.002 - 8
	SCALE: N.T.S	DATE: 24.9.2020		REVISION: 0

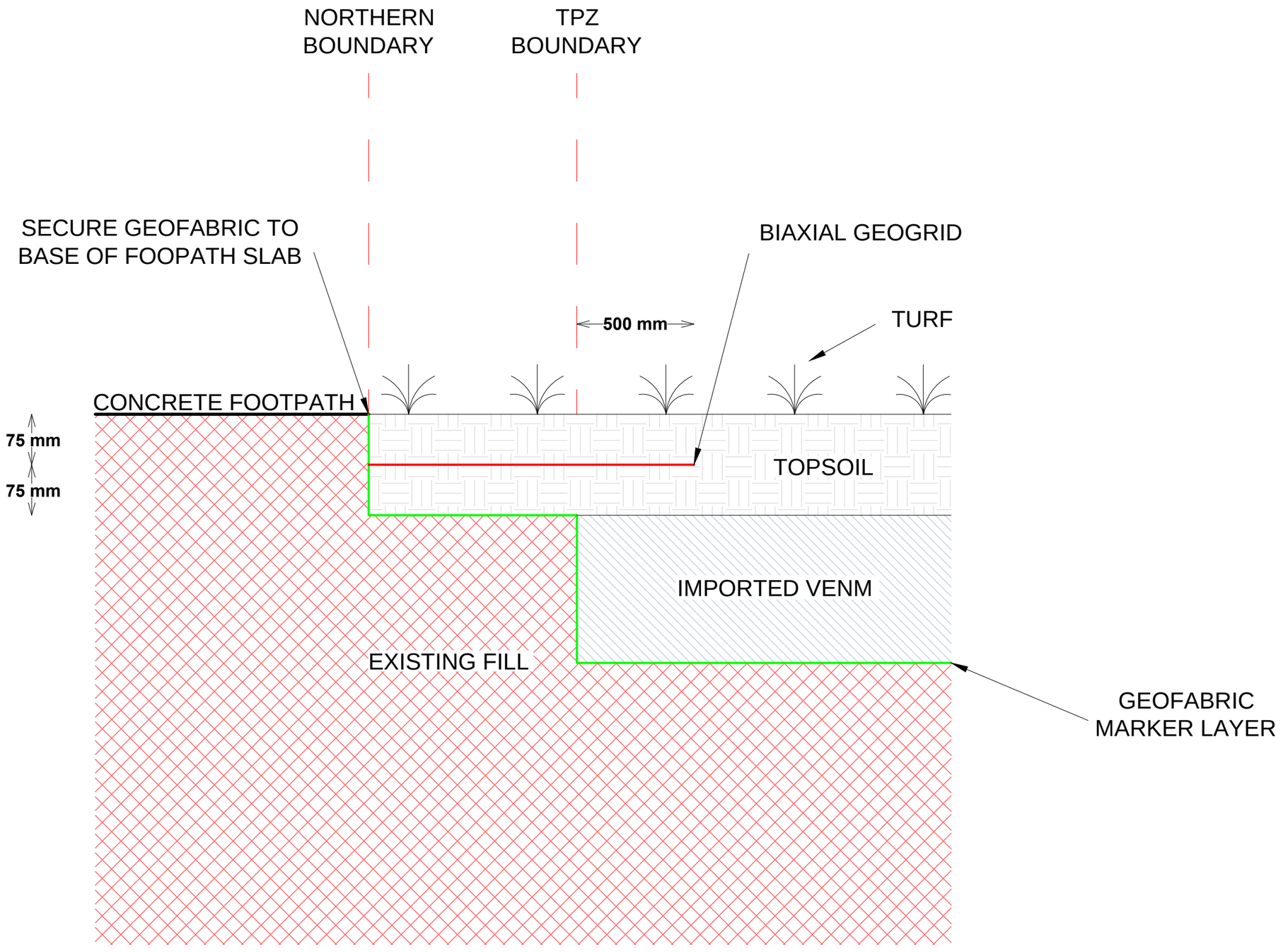




ALTERNATE APPROACH IF BATTERING IS
REQUIRED FOR GEOTECHNICAL PURPOSES

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: SJB Architects		TITLE: **Capping Approach - Western Boundary**	PROJECT No: 99751.00
OFFICE: Sydney	DRAWN BY: JDB	**Kogarah War Memorial Pool**	DRAWING No: R.002 - 9
SCALE: N.T.S	DATE: 24.9.2020	**Carss Park**	REVISION: 0



Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: SJB Architects	TITLE: **Capping Approach - Northern Boundary within TPZ (Type 3)** **Kogarah War Memorial Pool** **Carss Park**	PROJECT No: 99751.00
	OFFICE: Sydney / DRAWN BY: JDB		DRAWING No: R.002 - 10
	SCALE: N.T.S / DATE: 24.9.2020		REVISION: 0

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

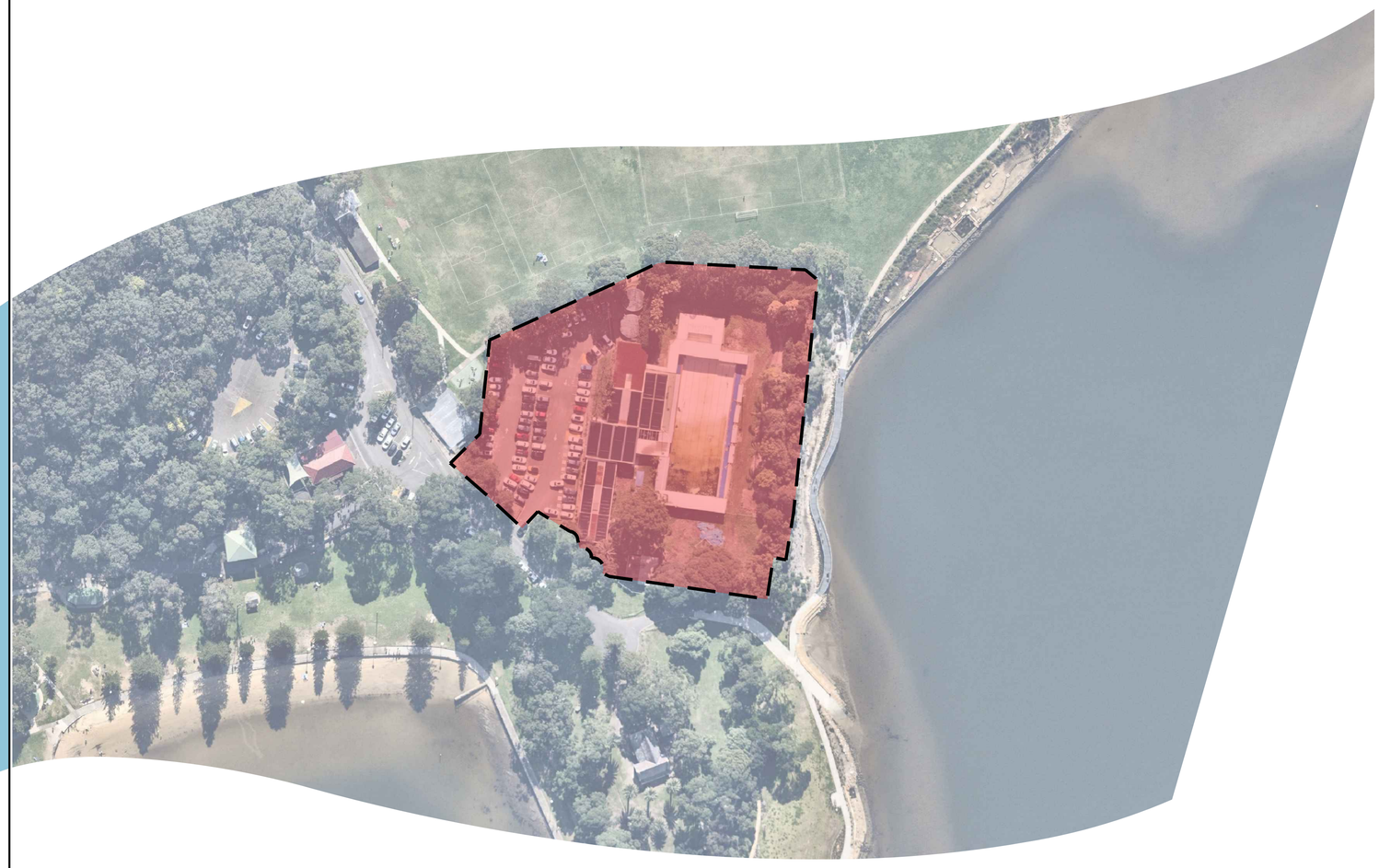
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Civil Drawings



SJB ARCHITECTS

KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

DRAWING SCHEDULE

DRAWING NUMBER	DESCRIPTION
200060-DA-C01.01	COVER SHEET AND DRAWING SCHEDULE
200060-DA-C01.21	GENERAL ARRANGEMENT PLAN
200060-DA-C03.01	EROSION AND SEDIMENTATION CONTROL PLAN
200060-DA-C03.21	EROSION AND SEDIMENTATION CONTROL DETAILS
200060-DA-C04.01	CUT AND FILL PLAN
200060-DA-C04.10	REMEDIATION PLAN
200060-DA-C05.01	SITEWORKS AND STORMWATER MANAGEMENT PLAN
200060-DA-C09.01	SITE SECTIONS

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
5	24/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	JT	RT	AD	AD
4	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
3	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
2	27/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
1	26/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale
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SCALE 1:1000 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Scale: 1:1000
Date: 26/08/2020
Size: A1
Datum: AHD

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number: 200060-DA-C01.01

Revision: 5

DATE PLOTTED: 24 September 2020 3:03 PM BY : JADE TAI

CAD File: P:\200060 KogarahPool\D-Civil\00-SiteWide\Drawings\6-DACC\200060-DA-C01.01 COVERSHEET.dwg

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
2	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
1	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

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SCALE 1:500 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project
KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title
GENERAL ARRANGEMENT PLAN

Scale 1:500
Date 09/09/2020
Size A1
Datum AHD

Status
FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number
200060-DA-C01.21

Revision 2

DATE PLOTTED: 24 September 2020 3:03 PM BY : JADE TAI

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LEGEND

- SITE FENCE
- SITE ENTRY/EXIT
- TEMPORARY CONSTRUCTION EXIT (WASH DOWN DETAIL)
- SEDIMENT FENCE (SD 6-8)
- MESH AND GRAVEL INLET FILTER (SD 6-11)
- GEOTEXTILE INLET FILTER (SD 6-12)
- TREE PROTECTION ZONE (TPZ)

EROSION AND SEDIMENT CONTROL

GENERAL INSTRUCTIONS

1. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONTROL OF EROSION AND SEDIMENTATION TO THE SATISFACTION OF COUNCIL, NSW OFFICE OF WATER, OFFICE OF ENVIRONMENT AND HERITAGE. THE EROSION AND SEDIMENTATION CONTROLS SHOWN ON THE DRAWINGS SHALL ONLY BE USED AS A GUIDE BY THE CONTRACTOR, AND SHALL REPRESENT THE MINIMUM REQUIREMENT ONLY.

2. THE CONTRACTOR SHALL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE LOCATED AS DOCUMENTED OR AS OTHERWISE DIRECTED BY THE SUPERINTENDENT.
   ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH
   a. LOCAL AUTHORITY REQUIREMENTS
   b. EPA REQUIREMENTS
   c. LANDCOM MANUAL "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004.

3. MAINTAIN THE EROSION CONTROL DEVICES TO THE SATISFACTION OF THE SUPERINTENDENT AND THE LOCAL AUTHORITY.

4. WHEN STORMWATER PITS ARE CONSTRUCTED, PREVENT SITE RUNOFF ENTERING UNLESS SEDIMENT FENCES ARE ERECTED AROUND PITS.

5. CONTRACTOR IS TO ENSURE ALL EROSION & SEDIMENT CONTROL DEVICES ARE MAINTAINED IN GOOD WORKING ORDER AND OPERATE EFFECTIVELY. REPAIRS AND OR MAINTENANCE SHALL BE UNDERTAKEN AS REQUIRED, PARTICULARLY FOLLOWING STORM EVENTS.

LAND DISTURBANCE

6. WHERE PRACTICAL, THE SOIL EROSION HAZARD ON THE SITE WILL BE KEPT AS LOW AS POSSIBLE. TO THIS END, WORKS SHOULD BE UNDERTAKEN IN THE FOLLOWING SEQUENCE:
   a. INSTALL A SEDIMENT FENCE ALONG THE BOUNDARIES AS SHOWN ON PLAN. REFER DETAIL.
   b. CONSTRUCT STABILISED CONSTRUCTION ENTRANCE TO LOCATION AS DETERMINED BY SUPERINTENDENT/ENGINEER. REFER DETAIL.
   c. INSTALL SEDIMENT BASIN AS SHOWN ON PLAN, INSTALL SEDIMENT TRAPS AS SHOWN ON PLAN.
   d. UNDERTAKE SITE DEVELOPMENT WORKS IN ACCORDANCE WITH THE ENGINEERING PLANS. WHERE POSSIBLE, PHASE DEVELOPMENT SO THAT LAND DISTURBANCE IS CONFINED TO AREAS OF WORKABLE SIZE.

EROSION CONTROL

7. DURING WINDY WEATHER, LARGE, UNPROTECTED AREAS WILL BE KEPT MOIST (NOT WET) BY SPRINKLING WITH WATER TO KEEP DUST UNDER CONTROL.

8. FINAL SITE LANDSCAPING WILL BE UNDERTAKEN AS SOON AS POSSIBLE AND WITHIN 20 WORKING DAYS FROM COMPLETION OF CONSTRUCTION ACTIVITIES.

SEDIMENT CONTROL

9. STOCKPILES WILL NOT BE LOCATED WITHIN 2 METRES OF HAZARD AREAS, INCLUDING LIKELY AREAS OF CONCENTRATED OR HIGH VELOCITY FLOWS SUCH AS WATERWAYS. WHERE THEY ARE BETWEEN 2 AND 5 METRES FROM SUCH AREAS, SPECIAL SEDIMENT CONTROL MEASURES SHOULD BE TAKEN TO MINIMISE POSSIBLE POLLUTION TO DOWNSLOPE WATERS, E.G. THROUGH INSTALLATION OF SEDIMENT FENCING.

10. ANY SAND USED IN THE CONCRETE CURING PROCESS (SPREAD OVER THE SURFACE) WILL BE REMOVED AS SOON AS POSSIBLE AND WITHIN 10 WORKING DAYS FROM PLACEMENT.

11. WATER WILL BE PREVENTED FROM ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS IT IS RELATIVELY SEDIMENT FREE, I.E. THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR ANY LIKELY SEDIMENT HAS BEEN FILTERED THROUGH AN APPROVED STRUCTURE.

12. TEMPORARY SOIL AND WATER MANAGEMENT STRUCTURES WILL BE REMOVED ONLY AFTER THE LANDS THEY ARE PROTECTING ARE REHABILITATED.

13. ACCEPTABLE RECEPTORS WILL BE PROVIDED FOR CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHINGS, LIGHT-WEIGHT WASTE MATERIALS AND LITTER.

14. ANY EXISTING TREES WHICH FORM PART OF THE FINAL LANDSCAPING PLAN WILL BE PROTECTED FROM CONSTRUCTION ACTIVITIES BY:
   a. PROTECTING THEM WITH BARRIER FENCING OR SIMILAR MATERIALS INSTALLED OUTSIDE THE DRIP LINE
   b. ENSURING THAT NOTHING IS NAILED TO THEM
   c. PROHIBITING PAVING, GRADING, SEDIMENT WASH OR PLACING OF STOCKPILES WITHIN THE DRIP LINE EXCEPT UNDER THE FOLLOWING CONDITIONS.
   (I) ENCROACHMENT ONLY OCCURS ON ONE SIDE AND NO CLOSER TO THE TRUNK THAN EITHER 1.5 METRES OR HALF THE DISTANCE BETWEEN THE OUTER EDGE OF THE DRIP LINE AND THE TRUNK, WHICH EVER IS THE GREATER
   (II) A DRAINAGE SYSTEM THAT ALLOWS AIR AND WATER TO CIRCULATE THROUGH THE ROOT ZONE (E.G. A GRAVEL BED) IS PLACED UNDER ALL FILL LAYERS OF MORE THAN 300 MILLIMETRES DEPTH
   (III) CARE IS TAKEN NOT TO CUT ROOTS UNNECESSARILY NOR TO COMPACT THE SOIL AROUND THEM.

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
3	24/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	JT	RT	AD	AD
2	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
1	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale: 0 5 10 20 30m — SCALE 1:300 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project: KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title: EROSION AND SEDIMENTATION CONTROL PLAN

Scale: 1:300
Date: 09/09/2020
Size: A1
Datum: AHD

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number: 200060-DA-C03.01
Revision: 3

DATE PLOTTED: 24 September 2020 3:03 PM BY : JADE TAI

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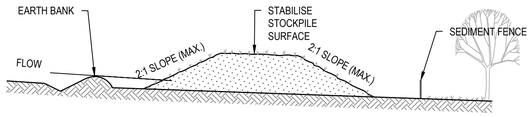
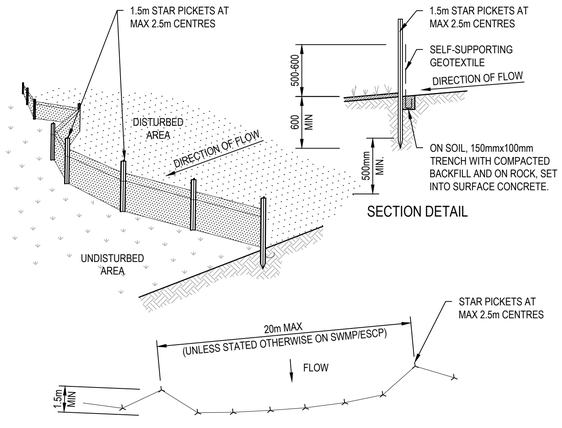


CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE.

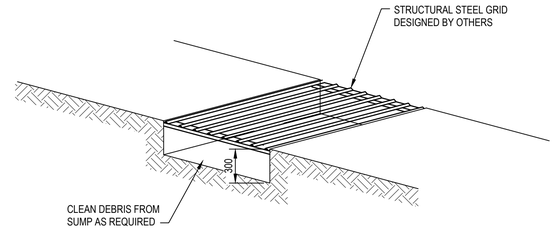
STOCKPILES (SD 4-1)



CONSTRUCTION NOTES

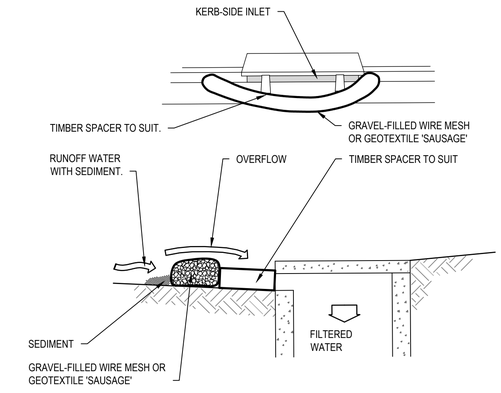
1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50 LITRES PER SECOND IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 1.5 METRE LONG STAR PICKETS INTO GROUND AT 2.5 METRE INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

SEDIMENT FENCE (SD 6-8)



SHAKER PAD

NOT TO SCALE

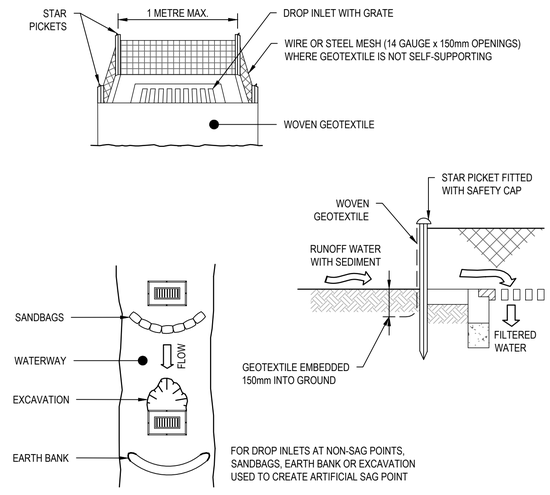


NOTE:THIS PRACTICE ONLY TO BE USED WHERE SPECIFIED IN APPROVED SWMP/ESCP.

CONSTRUCTION NOTES

1. INSTALL FILTERS TO KERB INLETS ONLY AT SAG POINTS.
2. FABRICATE A SLEEVE MADE FROM GEOTEXTILE OR WIRE MESH LONGER THAN THE LENGTH OF THE INLET PIT AND FILL IT WITH 25mm TO 50mm GRAVEL.
3. FORM AN ELLIPTICAL CROSS-SECTION ABOUT 150mm HIGH x 400mm WIDE.
4. PLACE THE FILTER AT THE OPENING LEAVING AT LEAST A 100mm SPACE BETWEEN IT AND THE KERB INLET. MAINTAIN THE OPENING WITH SPACER BLOCKS.
5. FORM A SEAL WITH THE KERB TO PREVENT SEDIMENT BYPASSING THE FILTER.
6. SANDBAGS FILLED WITH GRAVEL CAN SUBSTITUTE FOR THE MESH OR GEOTEXTILE PROVIDING THEY ARE PLACED SO THAT THEY FIRMLY ABUT EACH OTHER AND SEDIMENT-LADEN WATERS CANNOT PASS BETWEEN.

MESH AND GRAVEL INLET FILTER (SD 6-11)



CONSTRUCTION NOTES

1. FABRICATE A SEDIMENT BARRIER MADE FROM GEOTEXTILE OR STRAW BALES.
2. FOLLOW STANDARD DRAWING 6-7 AND STANDARD DRAWING 6-8 FOR INSTALLATION PROCEDURES FOR THE STRAW BALES OR GEOFABRIC. REDUCE THE PICKET SPACING TO 1 METRE CENTRES.
3. IN WATERWAYS, ARTIFICIAL SAG POINTS CAN BE CREATED WITH SANDBAGS OR EARTH BANKS AS SHOWN IN THE DRAWING.
4. DO NOT COVER THE INLET WITH GEOTEXTILE UNLESS THE DESIGN IS ADEQUATE TO ALLOW FOR ALL WATERS TO BYPASS IT.

GEOTEXTILE INLET FILTER (SD 6-12)

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF	APPD.
1	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

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V: 0 2 4 6 8 10m
SCALE: H:1:500 V:1:100 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project: KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Scale: N.T.S
Date: 09/09/2020

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Title: EROSION AND SEDIMENTATION CONTROL DETAILS

Size: A1
Datum: AHD

Project Number/Drawing Number: 200060-DA-C03.21

Revision: 1

DATE PLOTTED: 24 September 2020 3:03 PM BY: JADE TAI

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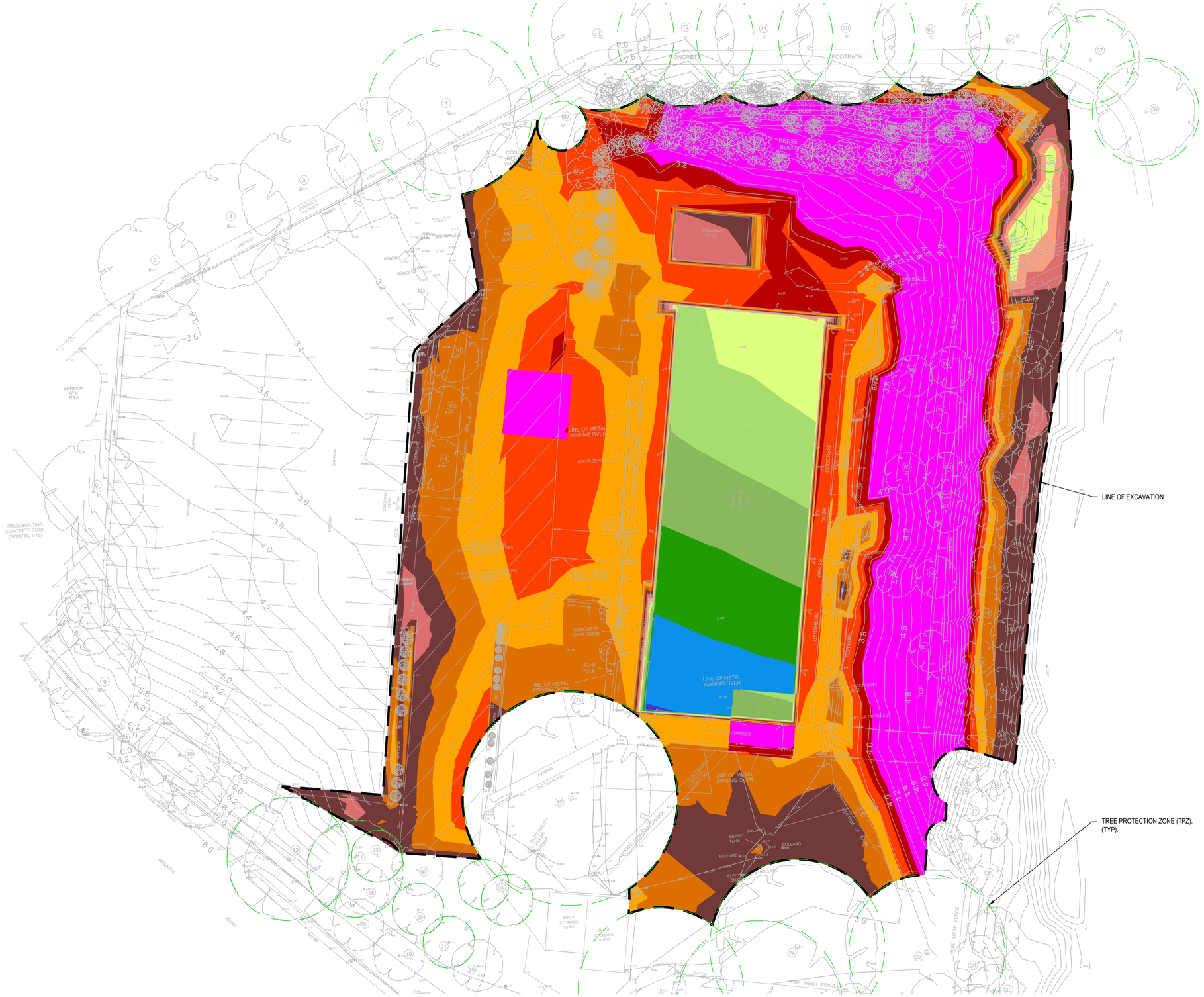

CUT AND FILL LEGEND

- GREATER THAN 1.4m CUT
- 1.2m TO 1.4m CUT
- 1.0m TO 1.2m CUT
- 0.8m TO 1.0m CUT
- 0.6m TO 0.8m CUT
- 0.4m TO 0.6m CUT
- 0.2m TO 0.4m CUT
- 0.0m TO 0.2m CUT
- 0.0m TO 0.2m FILL
- 0.2m TO 0.4m FILL
- 0.4m TO 0.6m FILL
- 0.6m TO 0.8m FILL
- 0.8m TO 1.0m FILL
- 1.0m TO 1.2m FILL
- GREATER THAN 1.2m FILL

CUT AND FILL VOLUMES

1. REFER SPECIFICATION NOTES FOR EARTHWORKS GENERAL REQUIREMENTS.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH COUNCIL/RELEVANT AUTHORITY SPECIFICATIONS AND DETAILS.
3. NO ALLOWANCE HAS BEEN MADE FOR BULKING FACTORS. NOTE ALL VOLUMES DEPICTED ARE SOLID VOLUMES ONLY AND MAY NOT REFLECT DETAILED EARTHWORKS.
4. NO ALLOWANCE HAS BEEN MADE FOR DETAILED EARTHWORKS. ie SERVICE TRENCHING, DETAILED EXCAVATION AND THE LIKE.
5. APPROXIMATE BULK EARTHWORK VALUES AS FOLLOWS;

5.1 CUT TO BE REMOVED FROM SITE 6,693 m³

5.2 CLEAN BACKFILL TO POOL 455 m³

5.3 CLEAN FILL FOR CAPPING LATER 3,621 m³

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
5	24/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	JT	RT	AD	AD
4	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
3	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
2	27/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
1	26/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale: 0 5 10 15 20 25m — SCALE 1:250 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project: KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title: CUT AND FILL PLAN

Scale: 1:250

Date: 26/08/2020

Size: A1

Datum: AHD

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number: 200060-DA-C04.01

Revision: 5

DATE PLOTTED: 24 September 2020 3:11 PM BY: - JADE TAI

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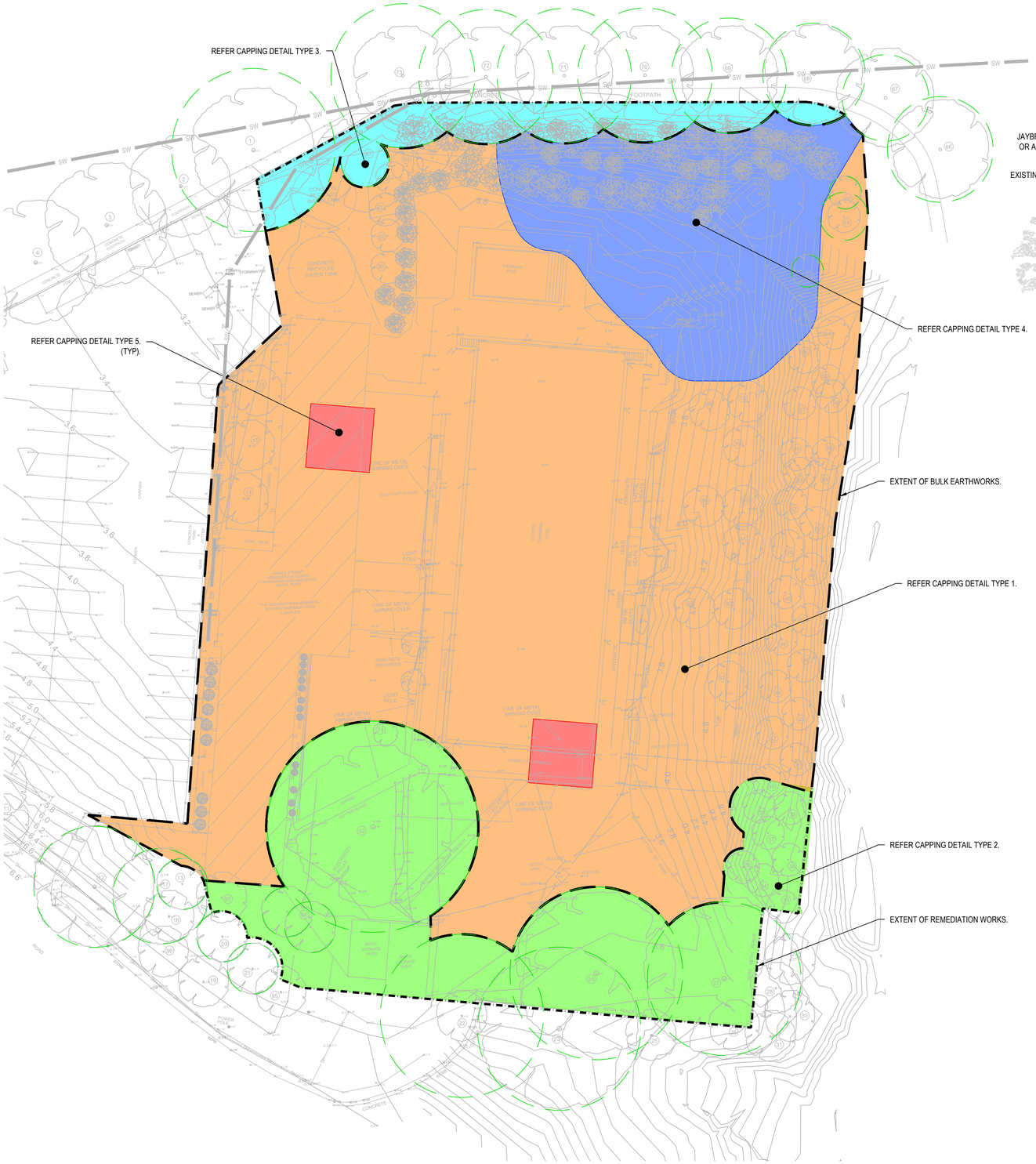
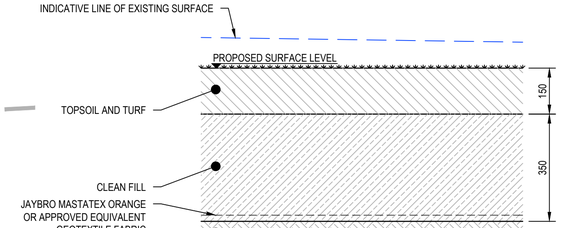
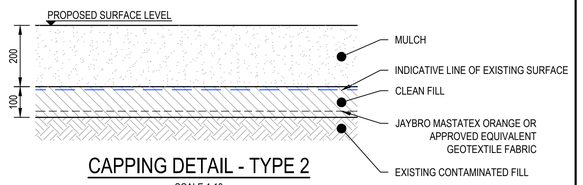




CAPPING DETAIL - TYPE 1

SCALE 1:10



CAPPING DETAIL - TYPE 2

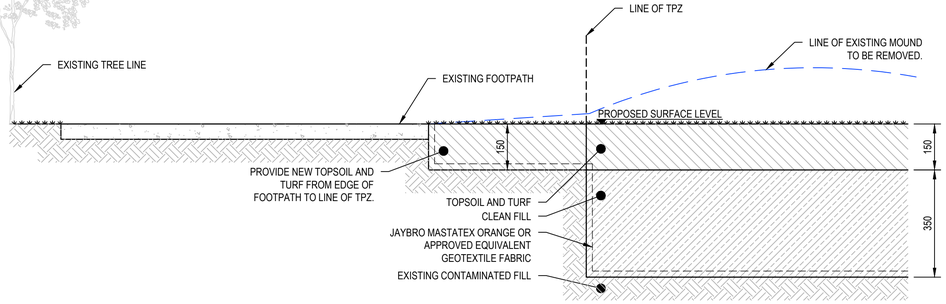
SCALE 1:10

NOTE:

1. STRIP EXISTING TOPSOIL 100mm PRIOR TO 300mm CAPPING.

NOTES

1. REFER GEOTECHNICAL REPORT PREPARED BY DOUGLAS PARTNERS FOR REMEDIATION REQUIREMENTS.



CAPPING DETAIL - TYPE 3

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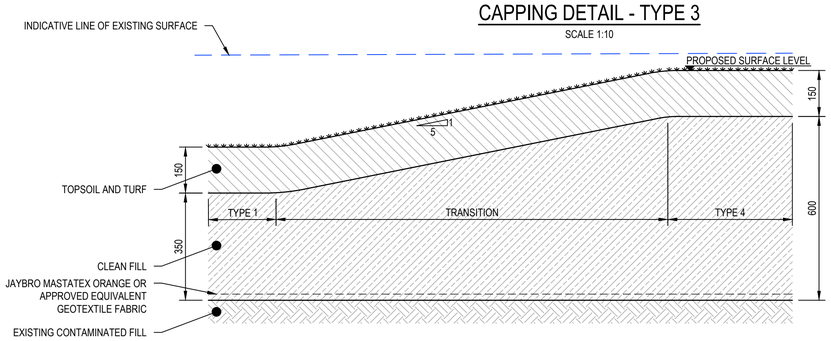
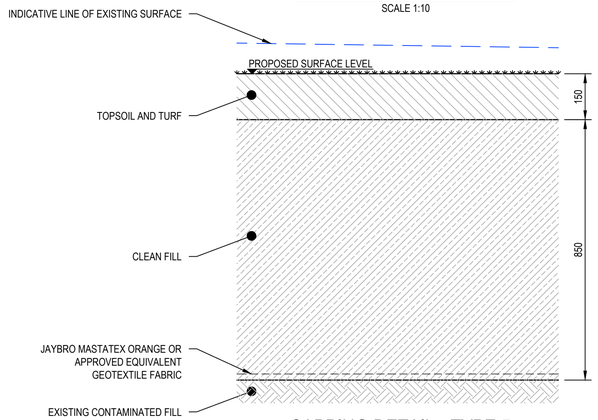


CAPPING DETAIL - TYPE 4

SCALE 1:10



CAPPING DETAIL - TYPE 5

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3	14/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
2	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
1	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale 0 5 10 20 30m
SCALE 1:300 @A1
0 200 400 600 800 1000mm
SCALE 1:10 @A1

North

enspire
Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project
KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title
REMEDIATION PLAN

Scale
AS SHOWN

Date
09/09/2020

Size
A1

Datum
AHD

Status
FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number
200060-DA-C04.10

Revision
4

DATE PLOTTED: 24 September 2020 3:04 PM BY: - JADE TAI

CAD File: P:\200060 KogarahPool\D-Civil\00-SiteWide\Drawings\6-DACC\200060-DA-C04.10 REMEDIATION PLAN.dwg

INDICATIVE LOCATION OF EXISTING STORMWATER PIPE.

EXTENT OF WORKS. (TYP).

MAINTAIN EXISTING STORMWATER PIT. (TYP).

MAINTAIN EXISTING STORMWATER PIPE. (TYP).

MEMORIAL WALL

MAINTAIN EXISTING CARPARK.

INDICATIVE LOCATION OF RECYCLED WATER SERVICE

PROPOSED ABOVE GROUND RAINWATER TANK

250mm MOUND ZONE.

PROPOSED TURF TO MATCH THE EXISTING MULCH PLANTED AREA AT THE TOP OF THE EXISTING BATTER.

EXTENT OF BULK EARTHWORKS.

1m DEEP SOIL ZONE. (TYP).

EXTENT OF REMEDIATION WORKS.

TREE PROTECTION ZONE (TPZ). (TYP).

LEGEND

- 3.00 — PROPOSED CONTOUR
- 3.00 — EXISTING CONTOUR
- RW — IRRIGATION TANK PIPE TRENCH
- OVERLAND FLOW DIRECTION
- SW — EXISTING STORMWATER PIPE

NOTES

1. THE PROPOSED CONTOURS REPRESENT THE FINISHED SURFACE LEVEL. (TOP OF CAPPING MATERIAL).
2. REFER ARBORICULTURAL DEVELOPMENT ASSESSMENT REPORT FOR TPZ.

METHODOLOGY

1. STRIP EXISTING VEGETATION AND REMOVE TOPSOIL.
2. DEMOLISH EXISTING STRUCTURES INCLUDING BUILDINGS, POOL COPING AND PAVEMENTS.
3. EXCAVATE TO 500mm BELOW PROPOSED SURFACE LEVELS AND REMOVE FROM SITE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT.
4. EXCAVATE 1m DEEP TREE PITS.
5. FILL POOL WITH CLEAN FILL MATERIAL TO 500mm BELOW PROPOSED SURFACE LEVEL.
6. COVER SITE WITH GEOTEXTILE LAYER.
7. FILL SITE WITH CLEAN MATERIAL (MIN 350mm FILL AND 150mm TOPSOIL).
8. TURF SITE.

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
5	24/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	JT	RT	AD	AD
4	11/09/2020	ISSUED FOR DEVELOPMENT APPLICATION	CB	RT	AD	AD
3	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
2	27/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
1	26/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale: 0 5 10 15 20 25m — SCALE 1:250 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project: KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title: SITEWORKS AND STORMWATER MANAGEMENT PLAN

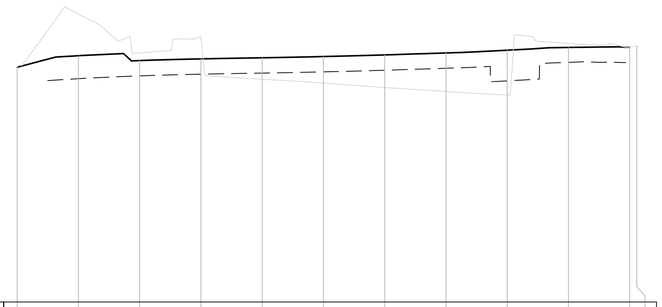
Scale: 1:250
Date: 26/08/2020
Size: A1
Datum: AHD

Status: FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number: 200060-DA-C05.01
Revision: 5

DATE PLOTTED: 24 September 2020 5:04 PM BY : JADE TAI

CAD File: P:\200060 KogarahPool\D-Civil\00-SiteWide\Drawings\6-DACC\200060-DA-C05.01 SITEWORKS PLAN.dwg



DATUM RL -5.0

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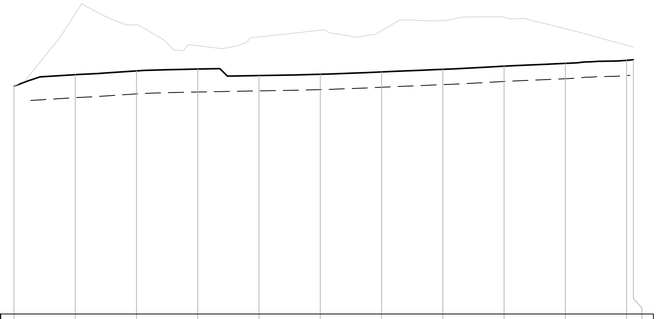
DESIGN SURFACE		3.04	2.88	2.94	2.97	3.01	3.06	3.13	3.22	3.31		
BULK SURFACE		2.29	2.38	2.44	2.47	2.51	2.56	2.63	2.22	2.82		
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	101.16

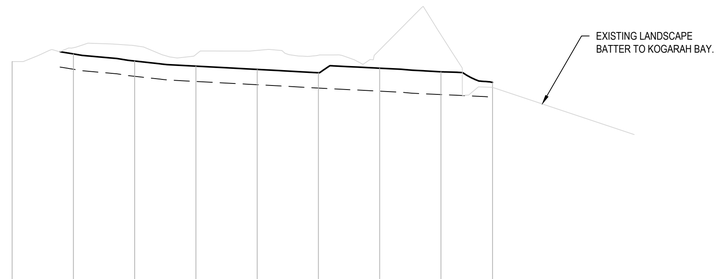
SECTION 1
SCALE 1:500 (H)
SCALE 1:100 (V)
C05.01



DATUM RL -5.0

EXISTING SURFACE	2.44	4.79	4.44	3.76	4.04	4.26	4.25	4.58	4.69	4.31	3.77	3.71
DESIGN SURFACE		2.81	2.93	3.00	2.78	2.82	2.90	2.99	3.09	3.18	3.28	3.30
BULK SURFACE		2.06	2.18	2.25	2.28	2.32	2.40	2.49	2.59	2.68	2.78	
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	101.12

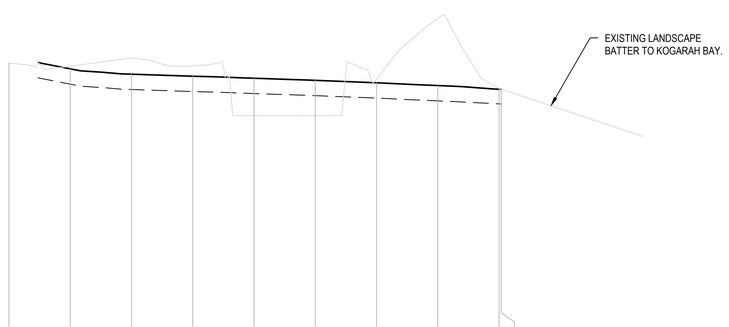
SECTION 2
SCALE 1:500 (H)
SCALE 1:100 (V)
C05.01



DATUM RL -4.0

EXISTING SURFACE	3.20	3.65	3.72	3.43	3.56	3.41	3.58	4.07	2.36
DESIGN SURFACE		3.45	3.22	3.05	2.94	2.83	2.98	2.86	2.52
BULK SURFACE		2.95	2.72	2.55	2.44	2.33	2.23	2.12	2.03
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	78.43

SECTION 3
SCALE 1:500 (H)
SCALE 1:100 (V)
C05.01



DATUM RL -5.0

EXISTING SURFACE	3.66	3.55	3.82	3.56	1.93	1.94	3.13	5.11	2.83	2.79
DESIGN SURFACE		3.46	3.29	3.22	3.16	3.09	3.01	2.92	2.80	2.80
BULK SURFACE		2.96	2.79	2.72	2.66	2.59	2.51	2.42	2.32	2.32
CHAINAGE	0.00	10.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	80.35

SECTION 4
SCALE 1:500 (H)
SCALE 1:100 (V)
C05.01

REV.	DATE	DESCRIPTION	DRN.	DES.	VERIF.	APPD.
3	09/09/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
2	27/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD
1	26/08/2020	ISSUED FOR REVIEW	CB	RT	AD	AD

Client

Scale
H: 0 10 20 30 40 50m
V: 0 2 4 6 8 10m
SCALE: H:1:500 V:1:100 @A1

North

Enspire Solutions Pty Ltd
205/275 Alfred Street N, North Sydney NSW 2060
ABN: 71 624 801 690
Phone: 02 9922 6135

Project
KOGARAH WAR MEMORIAL POOL
CARWAR AVENUE, CARSS PARK
DEVELOPMENT APPLICATION

Title
SITE SECTIONS

Scale
AS SHOWN

Date
26/08/2020

Size
A1

Datum
AHD

Status
FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION

Project Number/Drawing Number
200060-DA-C09.01

Revision
3

DATE PLOTTED: 24 September 2020 3:03 PM BY: JADE TAI

CAD File: P:\200060 KogarahPool\D-Civil\00-SiteWide\Drawings\6-DACC\200060-DA-C09.01 SITE SECTIONS.dwg

Appendix C

Site Photographs

Photo 1: Looking north showing a large crack in the pool wall

Photo 2: TP121 looking east showing fill material from beneath water table

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	1
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Photo 3: TP126 looking west showing the soil profile

Photo 4: P128 looking east showing soil profile and groundwater at base of test pit

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	2
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Photo 5: TP124 looking east showing soil profile with groundwater seepage at base of excavation

Photo 6: Looking south showing the location of TP120

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	3
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Photo 7: Looking north from the vicinity of TP128 showing the south eastern portion of the site

Photo 8: Looking north from the vicinity of BH109 showing the eastern site boundary and the berm

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	4
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Photo 9: Looking south from the vicinity of TP 122 showing the location of TP 120

Photo 10: Looking west from the vicinity of TP124 showing the north eastern portion of the site

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	5
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Photo 11: Looking south showing the existing car park from the vicinity of BH101 (not subject to remediation)

Photo 12: Looking west showing the car park from the vicinity of BH103 (not subject to remediation)

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT:	99751.00
	Kogarah War Memorial Swimming Pool	PLATE No:	6
	78 Carwar Avenue, Carss Park	REV:	1
	CLIENT: SJB Architects	DATE	28/08/20

Appendix D

Example Geotextiles

MASTATEX™ Orange

Warning Layer Geotextile

Techincal Specifications

Jaybro

GEOMASTA™

DESCRIPTION

mastaTEX™ GFO is a high quality staple fiber geotextile, designed for separating contaminated and non-contaminated soils. Due to its bright Orange coloring, mastaTEX™ GFO is most commonly used as a warning layer in areas liable to future excavations. mastaTEX™ GFO provides the same performance as other geotextiles in the mastaTEX™ range.

APPLICATIONS

- Segregation of contaminated soil
- Filtration
- Warning Layer

SPECIFICATIONS

	TEST METHOD	UNIT	VALUES
INDEX PROPERTIES			
Material			Polyester (PET)
Grab Tensile Strength	AS 3706.2B	N	500
Wide Strip Tensile Strength	AS3706.2A	kN/m	8.1
Mass	AS 3760.1	gsm	140
TYPICAL HYDRAULIC PROPERTIES MEAN			
Pore Size	AS 3706.7	µm (Microns)	120
Nominal Flow Rate	AS 3706.9	l/m² /s	240
DIMENSIONS			
Width		m	6
Length		m	150
Roll Diameter		m	400

UNDERSTANDING AUSTRALIAN GEOTEXTILE STANDARDS

NSW

ROADS & MARITIME SERVICES (RMS)
QA SPECIFICATION R63 GEOTEXTILES (SEPARATION AND FILTRATION)
May 2013 Edition 4 / Revision 0

RMS R63 is the NSW Main Roads specification documentation to which all Geotextile products are to be tested and approved before use on road and bridgeworks.

Clause 2 Material Requirements specifies the minimum requirements for the raw material quality, manufacturing processes, product testing & certification.

Clause 3 Storage, Packaging, Identification and Delivery specifies the method in which the product must be packaged, stored, marked and delivered.

Clause 4 Construction Requirements covers general site preparation, installation and site requirements.

Jaybro Geosynthetics recommend the client read and understand Clause 4 and all subsequent annexures prior to installation.

QLD

TRANSPORT AND MAIN ROADS (TMR) MRTS27 GEOTEXTILES SEPARATION AND FILTRATION
June 2009

Clause 6 Material Requirements specifies the minimum requirements for the raw material quality, manufacturing processes, product testing & certification.

Clause 7 Storage, Packaging and Identification specifies the method in which the product must be packaged, stored and marked.

Clause 8 Delivery and Product Compliance covers requirements for ordering and delivery of geotextiles.

Clause 9 Construction Requirements covers general site preparation, installation and site requirements.

Clause 10 Acceptance criteria details the requirements by the contractor for onsite testing and sampling.

Jaybro Geosynthetics recommend the client read and understand MRTS27 prior to installation.

VIC

VICROADS 210 – GEOTEXTILES IN EARTHWORKS
December 2014

This section covers the requirements for the supply, handling and placing of geotextiles as listed below or used as a separation layer, or as a separation and filtration layer,in earthworks at locations shown on the drawings or specified.

210.03 Properties of Geotextiles. General; specifies material properties and manufacturing process.

Robustness; outlines how the geotextiles are to be classified according to the G Rating

Equivalent Opening Size; specifies pore size for use as a filtration material

UV Radiation Stabilisation; The geotextile shall be stabilised against deterioration due to ultra-violet radiation such that when tested in accordance with AS 3706.11 Standard

Testing; All testing shall be performed by laboratories with third party accreditation to ISO/IEC 17025 by a signatory to the International Laboratories Accreditation Cooperation (ILAC) scheme, e.g. by NATA (National Association of Testing Authorities, Australia)

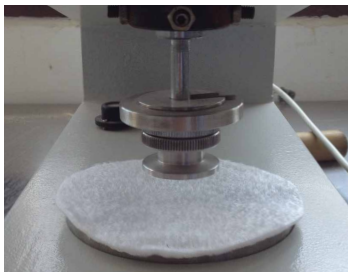
Jaybro Geosynthetics recommend the client read and understand VR210.04 and all subsequent annexuresprior to installation

NATA
WORLD RECOGNISED ACCREDITATION

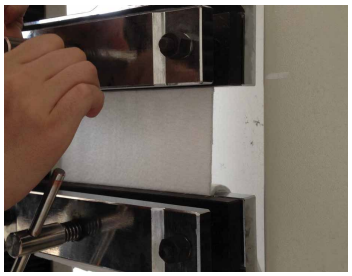
WHAT IS NATA?

National Association of Testing Authorities is the authority responsible for the accreditation of laboratories, inspection bodies, calibration services, producers of certified reference materials and proficiency testing scheme providers throughout Australia. It is also Australia's compliance monitoring authority for the OECD Principles of GLP. All State Standards specify geotextile testing must be completed by a NATA accredited laboratory.

TEST METHODS



AS 3706.1
MASS & THICKNESS



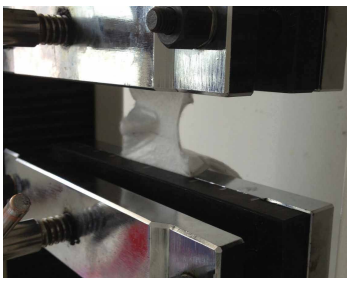
AS 3706.2A
WIDE STRIP TENSILE STRENGTH

AS 3706.2B
GRAB TENSILE STRENGTH

AS 3706.4
CBR BURST STRENGTH

AS 3706.9
PERMITTIVITY

AS 3706.7
PORE SIZE



AS 3706.3
TRAPEZOIDAL TEAR STRENGTH

Jaybro
GEOMASTA™

SYDNEY
29 Penelope Crescent
Arndell Park NSW 2148

MELBOURNE EAST
Factory 3, 1364 Heatherton Road
Dandenong VIC 3175

CANBERRA
3 Daly Street,
Queanbeyan West NSW 2620

COFFS HARBOUR
Unit 5, 22 Isles Drive
Coffs Harbour NSW 2450

PERTH
Unit 1/94 Beringarra Avenue,
Malaga WA 6090

MELBOURNE
27 Tullamarine Park Road
Tullamarine VIC 3043

BRISBANE
71 Lavarack Avenue
Eagle Farm QLD 4009

NEWCASTLE
100 Glenwood Drive
Thornton NSW 2322

ADELAIDE
391 Churchill Road,
Kilburn SA 5084

AUCKLAND (NZ)
Unit2, 25 Allright Place,
Mount Wellington Auckland 1060

1300 885 364 jaybro.com.au

GEOMASTA™

MASTAGRID™ *Poly*

Polypropylene Geogrid 40/40

TECHNICAL SPECIFICATIONS

WORLD-CLASS GEOSYNTHETICS. UNBEATABLE VALUE. EXCEPTIONAL SERVICE.

DESCRIPTION

mastaGRID™ Poly is an engineered polypropylene geogrid designed for soil stabilisation, separation & reinforcement applications. This is done through the process of extruding, polypropylene sheets then both stretching in both longitudinal and transverse directions. mastaGRID™ Poly rigid biaxial geogrids perform best in granular, angular fills and are used under roads, railways, loading platforms for sub-base soil reinforcement & stabilisation.

APPLICATIONS

- Base Reinforcement
- Subgrade Reinforcement
- Embankment Stabilisation
- Slope Reinforcement

SPECIFICATIONS

			GGPB4040	
INDEX PROPERTIES	**TEST METHOD**	**UNITS**	**MD VALUES**	**TD VALUES**
Polymer		-	PP	-
Minimum Carbon Black	ASTM D 4218	%	2	-
Tensile Strength @ 2% strain	ASTM D 6637	kN/m (lb/ft)	14 (960)	14 (960)
Tensile Strength @ 5% strain	ASTM D 6637	kN/m (lb/ft)	28 (1,920)	28 (1,920)
Ultimate Tensile Strength	ASTM D 6637	kN/m (lb/ft)	40 (2,740)	40 (2,740)
Strain @ Ultimate Strength	ASTM D 6637	%	13	13
Junction Efficiency	GRI GG2	%	93	93
Flexural Rigidity	ASTM D 7748	mg-cm	4,800,000	-
Aperture Stability	ASTM D 7864	m-N/deg	0.98	-
DIMENSIONS				
Aperture Dimensions	-	mm (in)	33 (1.3)	33 (1.3)
Minimum Rib Thickness	ASTM D 1777	mm (in)	3.4 (0.13)	3.4 (0.13)
Roll Width	-	m (ft)	3.95 (12.9)	-
Roll Length	-	m (ft)	50 (164)	-
RECOMMENDED OVERLAP				
Standard Soil	-	mm	200	-
Soft /Unstable soil	-	mm	500	-

SYDNEY
29 Penelope Crescent
Arndell Park NSW 2148

BRISBANE
71 Lavarack Avenue
Eagle Farm QLD 4009

NEWCASTLE
100 Glenwood Drive
Thornton NSW 2322

PERTH
6 Riversdale Road,
Welshpool WA 6106

CHRISTCHURCH
Warehouse 2 Kennaway Road,
Woolston Christchurch 8023

MELBOURNE
Building A 1-7 Cyanamid Street
Laverton North VIC 3026

CANBERRA
3 Daly Street,
Queanbeyan West NSW 2620

ADELAIDE
391 Churchill Road,
Kilburn SA 5084

AUCKLAND
8-10 Hannigan Drive,
St Johns Auckland 1072

STANDARD TEST METHODS

GEOGRID PROPERTY TO BE TESTED	TEST METHOD*	TEST NAME
Ultimate Tensile Strength/ Tensile Strength at 2% Strain	ASTM D6637-11 or EN ISO 10319	Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
Wide Width Tensile Tests (@ 2% and 5% strain)	ASTM D4595 or EN ISO 10319	Standard Test Method for Tensile Properties of Geotextile by the Wide-Width Strip Method
Installation Damage	ASTM D5818-11	Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics
Junction Strength	ASTM D7737-11 (Method B – Confined)	Individual Geogrid Junction Strength
Resistance to UV	ASTM D4355-07	Standard Test Method for Determination of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
Coefficient of Direct Shear Note 1	ASTM D5321/D5321M-14	Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

Note 1
Direct shear test shall apply vertical stress of 50kPa, 100kPa and 150kPa. Base layer shall consist of granular material with friction angle of 30 degree.of a soil sample.

PAVEMENT GEOSYNTHETIC PROPERTY REQUIREMENT

SUBGRADE REINFORCEMENT TYPE			TYPE 1	TYPE 2
Property	Test Method*	Unit	Subgrade Application (CBR > 3%)	Subgrade Application (CBR ≤ 3%)
Application	-	-	Reinforced subgrade with CBR > 3%	Reinforced subgrade with CBR ≤ 3%
Geogrid aperture size	-	mm	Min ≥ D50 ≈ 9.5 mm Max ≤ 2 x	Min ≥ D50 ≈ 9.5 mm Max ≤ 2 x D85 ≈ 38 mm
Geogrid junction strength at 2% strain	ASTM D7737-11	kN/m	≥ 9.5	≥ 12.5
Tensile strength (Ts) at 2% strain in any direction of the MD and CMD Note 1	ASTM D6637-11 / ASTM D4595 or EN ISO 10319	kN/m	≥ 10.5	≥ 14
Resistance to installation damage (Rd) Note 1 & 2	ASTM D5818-11	%	≥ 85	≥ 85
Resistance to UV (Ruv) Note 1	ASTM D4355-07	%	≥ 90	≥ 90
Coefficient of direct shear	ASTM D5321/D5321M-14	%	≥ 75	≥ 75

Note 1
For Tensile Strength (Ts) shall be at 2% strain taken from load vs strain curves obtained from a NATA approved laboratory to demonstrate the Ultimate Tensile Strength (UTS). Ts @ 2% ≤ UTS x Rd x Ruv x Rc x Rm. Other recognised laboratories can be considered provided they are recognised by NATA or NATA MRA (Mutual Recognition Arrangements) or GAI-LAP (USA). Refer to Clause 5.1.

For biaxial product, minimum strength from both directions should satisfy the requirement of Table 6.2. For uniaxial product, minimum strength from the principal direction should satisfy the requirement of Table 6.2

Note 2
The particle grading used for the installation damage test result determined in accordance with ASTM D5818 shall use a particle grading consistent with grading C of Table 7.2.4-A as defined in MRTS05 Unbound Pavements.

Note 3
D50: The particle size represented by the "50 percent passing" point when conducting a sieve analysis of a soil sample.

D85: The particle size represented by the "85 percent passing" point when conducting a sieve analysis of a soil sample.

Note 4
Pavement geosynthetic reinforcement to be used in natural subgrades with pH value between 4 and 9.

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Welshpool WA 6106

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Woolston Christchurch 8023

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Queanbeyan West NSW 2620

ADELAIDE
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Kilburn SA 5084

AUCKLAND
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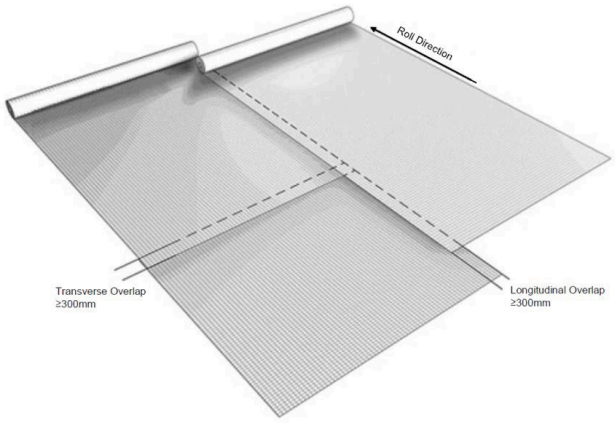
St Johns Auckland 1072



OVERLAP

The recommended minimum overlap for woven geotextile is 1000 mm in all directions for all subgrade CBR values. The recommended minimum geogrid/geocomposite overlaps are shown below:

SUBGRADE CBR	MINIMUM OVERLAP
> 2	300 - 450mm
1 – 2	600 - 900mm
0.5 – 1	900mm
< 0.5	Advice from Engineering and Technology Branch to be obtained
All roll ends	900mm
All woven geotextiles	Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

TESTING OF SITE SAMPLES

The tensile strength at 2% strain of the sampled pavement geosynthetics shall be tested by the Contractor:

Identification information including the pavement geosynthetic
supplier, type, batch identification, and details of the order represented by sample, sample date and roll directional markings shall be shown on or attached to the test reports.

The tensile strength at 2% strain test results shall be calculated from the results of tests carried on a minimum number of five test specimens.
For the appropriate test method refer Table 4.

The characteristic value of the strength properties listed in Table 9.3 shall be calculated in accordance with the requirements of Clause 12 of MRTS01 Introduction to Technical Specifications.

PROPERTY	CHARACTERISTIC VALUE REQUIREMENT FOR COMPLIANCE	
	TYPE 1	TYPE 2
Application	Subgrade Application (CBR > 3%)	Subgrade Application (CBR ≤ 3%)
Tensile strength (Ts) at 2% strain in any MD and CMD*(kN/m)	10.5	14

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